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ABSTRACT

This annual volume is a compilation of traditional articles, poster publications and clinical reports addressing speech and language impairments and intervention. Featured articles include: (1) "Pantomime Recognition and Pantomime Expression in Persons with Aphasia" (Joseph J. Langhans); (2) "Bilingual Classroom Discourse Skills: An Ethnographic Study" (Alejandro Brice and others); (3) "Disordered Cuban Spanish and American English Phonology" (Alejandro Brice and Alina de la Paz); (4) "Open Water Caloric Reference Values" (Frederick E. Cobb); (5) "Specificity in a Universal Hearing Screening Protocol: A Poster Publication" (Brett E. Kemker and others); (6) "'The Salesman Told Me This Was the Right Microphone?!' A Tutorial in Reading and Interpreting Microphone Specifications for Accurate Voice Recording: A Poster Publication" (Wesley A. Bulla and Edie R. Hapner); (7) "Effectiveness of an Adhesive Wax Guard for ITE Hearing Aids: A Poster Publication" (Sook Yul Ahn and others); (8) "Unusual Dysfluency: Repetitions in Final Position in an Adolescent Boy. A Poster Publication" (Brian D. Humphrey); (9) "Effect of Combining Speech-Language Intervention with Breakfast in Patients with Alzheimer's Disease: A Clinical Note" (Ann M. Reynolds); and (10) "Achievement of Client Expectations When Treating a Presurgical Male-to-Female Transsexual for a More Appropriate Female-Sounding Voice: A Clinical Note" (Frederick DiCarlo). (Articles contain references.) (CR)

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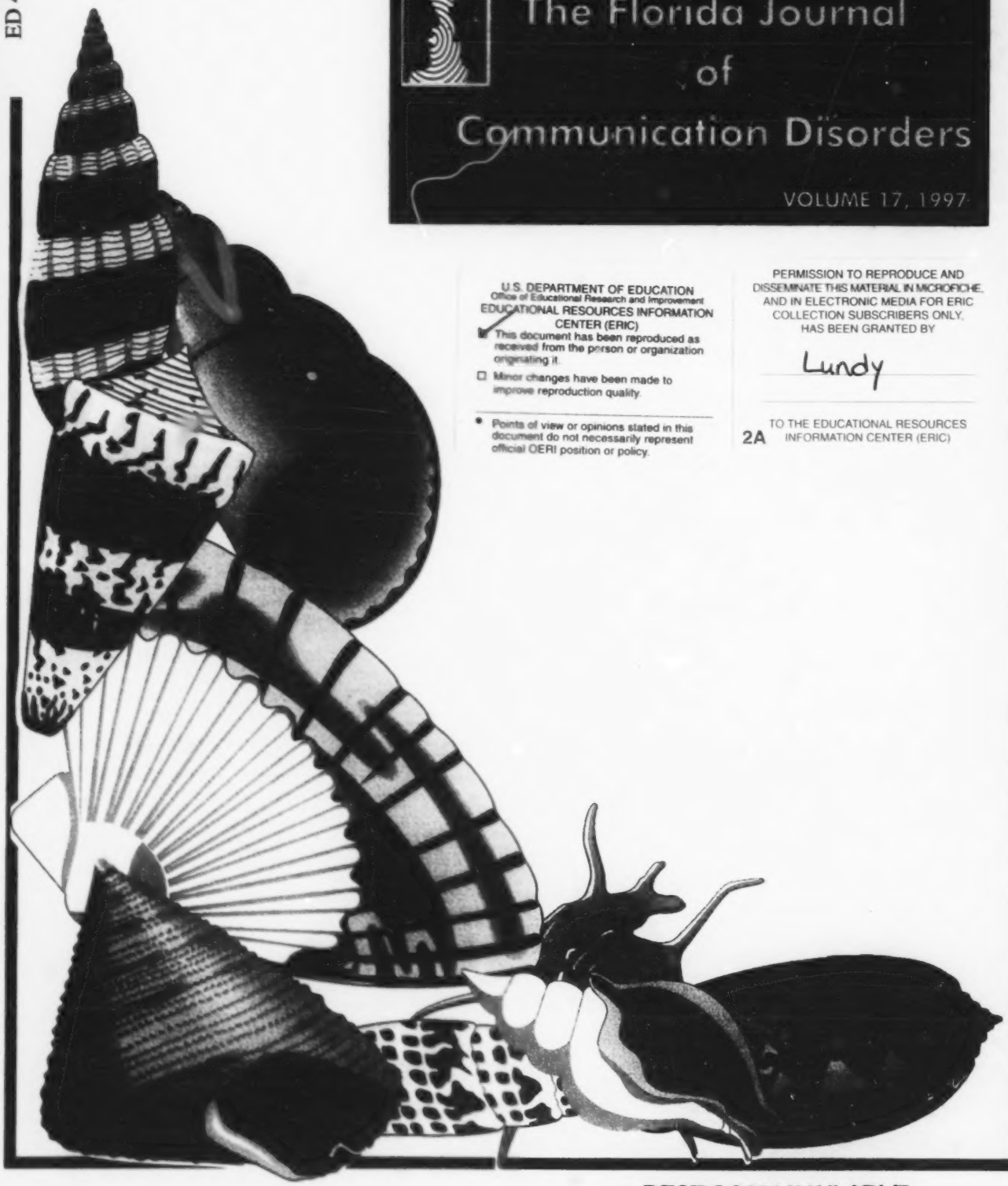

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Contents

Florida Association of Speech-Language Pathologists and Audiologists
VOLUME 17 **Florida Journal of Communication Disorders** 1997

Pantomime Recognition and Pantomime Expression in Persons with Aphasia ..... **Page 3**
Joseph J. Langhans

Bilingual Classroom Discourse Skills: An Ethnographic Study ..... **Page 11**
Alejandro Brice
Marla Mastin
Carol Perkins

Disordered Cuban Spanish and American English Phonology ..... **Page 20**
Alejandro Brice
Alina de la Paz

Open Water Caloric Reference Values ..... **Page 25**
Frederick E. Cobb

Specificity in a Universal Hearing Screening Protocol: A Poster Publication ..... **Page 31**
Brett E. Kemker
Scott K. Griffiths
F. Joseph Kemker
Alice E. Holmes
Emily T. McClain

"The salesman told me this was the right microphone?!" A Tutorial in Reading and Interpreting Microphone Specifications for Accurate Voice Recording: A Poster Publication **Page 34**
Wesley A. Bulla
Edie R. Hapner

Effectiveness of an Adhesive Wax Guard for ITE Hearing Aids: A Poster Publication ..... **Page 37**
Sook Yul Ahn
Theresa Hnath-Chisolm
Harvey B. Abrams
Bob Oliveria

Unusual Dysfluency: Repetitions in Final Position in an Adolescent Boy: A Poster Publication ..... **Page 41**
Brian D. Humphrey

Effect of Combining Speech-Language Intervention with Breakfast in Patients with Alzheimer's Disease: A Clinical Note ..... **Page 43**
Ann M. Reynolds

Achievement of Client Expectations When Treating a Presurgical Male-to-Female Transsexual for a More Appropriate Female-Sounding Voice: A Clinical Note ..... **Page 46**
Frederick DiCarlo

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FOREWARD

Volume 17 of the *Florida Journal of Communication Disorders* is a compilation of traditional articles, poster publications and clinical reports. The topics are varied and include a reasonable cross section of contemporary issues. A review of the literature regarding a disturbance of nonverbal communication (pantomime recognition and pantomime expression) in persons with aphasia is authored by Dr. Joseph J. Langhans. Further needed research, the controversies and equivocation persist. Systematic research regarding diversity and multicultural issues is a particularly relevant topic of interest today in speech-language pathology. Education leading to the efficient and efficacious evaluation and treatment of multilingual/multicultural persons is a "need" area. To further enhance and elucidate the literature base, Dr. Alejandro Brice and colleagues discuss bilingual classroom discourse skills from an ethnographic perspective. Further insight is provided by Dr. Brice and Ms. Alina de la Paz in contrasting disordered Cuban Spanish and American English phonology. A large reliable and valid data base is essential in the conduct of the electronystagmography (ENG) battery. Dr. Frederick E. Cobb shares with the readership reference values for open water caloric testing obtained in his ENG lab.

New to the *Florida Journal* are poster publications. In recent years, the poster format has become an increasingly popular mode of disseminating pertinent information at professional conferences and conventions. Although this format differs from the traditional journal article format, such a format has promoted professional discussion at conferences/conventions and has proved to be a significant mode for communicating useful information. In this issue of the *Florida Journal of Communication Disorders*, several poster publications are included. The effectiveness and efficiency of a universal neonatal hearing screening program is detailed by Mr. Brett E. Kemker and colleagues. Mr. Wesley Bulla and Ms. Edie Hapner tell us what we really need to know to select just the right microphone for clinical or research endeavors. The effectiveness of using an adhesive wax guard for ITE hearing aids is discussed by Ms. Sook Yul Ahn and colleagues. Mr. Brian D. Humphrey reports on a case of unusual dysfluency.

Finally, two clinical notes are included: one addressing communication stimulation and interaction with persons having Alzheimer's disease authored by Ms. Ann M. Reynolds and one discussing clinical events related to treating voice in a person in the process of sex change by Mr. Frederick DiCarlo.

The Executive Board, Editorial Board and Review Committee, and Editor truly hope the readership will find the contents of the *Florida Journal* relevant professionally. Speech-language pathologists, audiologists and related professionals are encouraged to contribute contemporary manuscripts addressing the study of human communication, swallowing and their disorders to the *Florida Journal*.

Joseph J. Langhans, Editor

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Pantomime Recognition and Pantomime Expression in Persons with Aphasia

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Although reports of the presence of a disturbance of nonverbal communication (pantomime recognition and expression) in persons with aphasia are consistent, there are conflicting reports regarding the explanation for such a disturbance. Both methodological and philosophical differences in the research conducted contribute. Pertinent investigations are reviewed, the rationale for conclusions reported and explanations proposed by various researchers are presented.

The literature is explicit; persons with aphasia as a group manifest a disturbance of pantomime recognition and pantomime expression. A number of explanations have been proposed to account for each. The disturbance of pantomime recognition has been explained as a central symbolic disorder (Duffy & Duffy, 1981), a disturbance at the semantic level of integration (Gainotti & Lemmo, 1976), a specific aphasic alexia (Varney, 1978, 1982) and relative to a plausibility factor not of a linguistic nature (Seron, van der Kaa, Remitz and van der Linden, 1979). The disturbance of pantomime expression has been more controversial. This disturbance has been explained as a central symbolic disorder (Duffy & Duffy, 1981), an ideomotor apraxia (Gainotti & Lemmo, 1976; Goodglass & Kaplan, 1963) and as the consequence of general intellectual deterioration (Bastian, 1898; Critchley, 1939, Goldstein, 1948).

Statistically significant differences in pantomime recognition have been reported between left-hemisphere damaged subjects with aphasia and left-hemisphere damaged subjects without aphasia (Gainotti & Lemmo, 1976), right-hemisphere damaged subjects (without aphasia), subcortically damaged subjects (without aphasia) and controls (Duffy, Duffy & Pearson, 1975; Duffy & Duffy, 1981). Similarly statistically significant differences in pantomime expression have been reported between left-hemisphere damaged subjects with aphasia and brain damaged subjects without aphasia (Goodglass & Kaplan, 1963), right-hemisphere damaged subjects (without aphasia) (Duffy & Duffy, 1981) and controls (Duffy & Duffy, 1981; Duffy, Watt & Duffy, 1978). In none of the aforementioned studies was a statistically significant difference reported between normal controls and a nosological group other than left-hemisphere damaged subjects with aphasia for either pantomime recognition or pantomime expression. Right-hemisphere damaged subjects with aphasia (crossed aphasia) do not appear to have been studied. Persons with Alzheimer's disease have been investigated also and have demonstrated a disturbance of pantomime, both recognition and expression (Kempler, 1984; Langhans, 1985).

This report reviews the literature regarding a disturbance of pantomime recognition and pantomime expression in persons with aphasia. Each investigation is reviewed succinctly with detail sufficient to elucidate the subjects included, procedure and stimuli used, data analysis and conclusions drawn by investigators.

Pantomime Recognition in Persons with Aphasia

Duffy, Duffy and Pearson (1975) provided what was perhaps the first systematic report of a disturbance of pantomime recognition in persons with aphasia. The impetus leading these authors to investigate pantomime recognition came from two sources: (1) comments by aphasiologists that persons with aphasia demonstrated difficulty communicating using signs, gestures, pantomime, mimicry or other alternatives to verbal communication and (2) observations by Duffy, Duffy and Pearson conforming with such comments.

Duffy et al. (1975) addressed the following questions: (1) do persons with aphasia demonstrate a distinctive disturbance of pantomime recognition when compared to other brain-injured and non-brain-injured subjects? and (2) what is the relationship between the severity of a disturbance of pantomime recognition and the severity of language disturbance among persons with aphasia?

The authors developed and administered a 50-item Pantomime Recognition Test to four groups of subjects: persons with aphasia (n=44), right-hemisphere damaged persons without aphasia (n=30), persons with subcortical injury (n=26) and controls (n=30). Using one-tailed t-tests, statistically significant differences were obtained between the aphasia group and all other groups ($p<.05$) indicating that aphasic subjects as a group had more difficulty performing these tasks. In addition, significant relations were observed between pantomime and verbal recognition ($r=.83$, $p<.05$), pantomime recognition and naming ($r=.58$, $p<.05$) and pantomime recognition and overall score on the Porch Index of Communicative Ability (Porch, 1967, 1973) ($r=.79$, $p<.05$) for the aphasia group.

In light of this evidence, Duffy, Duffy and Pearson (1975) concluded, as did Finkelnburg (1870) more than one century earlier, that aphasia is perhaps best understood as a general impairment of symbolic communication including both nonverbal and verbal symbolic deficits.

Gainotti and Lemmo (1976) investigated the comprehension of symbolic gestures in four groups of subjects: left-hemi-

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sphere damaged persons with aphasia (n=53), left-hemisphere damaged persons without aphasia (n=26), right-hemisphere damaged persons without aphasia (n=49) and controls (n=25). The purposes of their study were: (1) to determine if persons with aphasia have less difficulty performing a symbolic gesture comprehension task using a nonverbal and multiple choice format (compared to previous observations in which verbal instructions were used) and (2) to determine the relationship between symbolic gesture comprehension and a test of ideomotor apraxia. All subjects were administered a 10-item test of symbolic gesture interpretation, an 8-item test of ideomotor apraxia and a 20-item Verbal Sound and Meaning Discrimination Test.

For the test of symbolic gesture interpretation, each of 10 items was pantomimed expressively by the examiner. Subjects were required to point to the pictured object (out of three) that represented the examiner's pantomime of an action associated with the use of a target object. Besides the target (e.g., guitar), a non-specifically related object (e.g., trumpet) and an unrelated object (e.g., bird) were shown for each item. The test of ideomotor apraxia consisted of eight symbolic gestures. These "commonly used, conventionalized communicative movements" were performed from verbal instruction. For those cases in which instructions were not comprehended or the act performed unsatisfactorily, subjects were allowed an imitation trial. Items comprising this measure were unspecified by the authors; however, they served to elicit responses according to which the second purpose of this study was analyzed. The third measure, the Verbal Sound and Meaning Discrimination Test, was described as a test of verbal auditory comprehension and, therefore, said to test both the "phonemic and the semantic aspects of the auditory perception of verbal sounds." This test consisted of 20 words which were read aloud by the examiner. After each, the subject was shown a card containing six pictures: one matching the word read aloud, a second phonetically similar to the target, a third semantically similar but different phonetically and three unrelated objects. The authors contended that the relationship between both the verbal and nonverbal aspects of "semantic disintegration" in aphasia could be compared in contrasting the performance of aphasic subjects on the gestural and discrimination measures.

Using chi square tests, differences between the aphasia group and both the left-hemisphere damaged group without aphasia and the right-hemisphere damaged group without aphasia were significant [x^2 (1, n=79) = 18.09, $p<.001$ and x^2 (1, n=102) = 26.97, $p<.001$, respectively]. Differences between the control group and the three brain-damaged groups were unreported. Presumably, the aphasia and control group would have differed significantly as well. For the aphasia group, scores obtained on the symbolic gesture interpretation measure and number of semantic errors on the verbal sound and meaning discrimination measure were significantly related ($r_s=.54$, $p<.001$). Using chi square procedure, the relationship between difficulty comprehending symbolic gestures (pantomime recognition) and difficulty reproducing the conventional, symbolic gestures (praxis) was significant [x^2 (1, n=53) = 3.86, $p<.05$]; however, it did not reach significance using the Spearman rank order correlation procedure ($r_s=2.65,>.05$).

As a result of these findings, Gainotti and Lemmo (1976) concluded that a disturbance of symbolic gesture comprehension (pantomime recognition) in persons with aphasia is best explained either as a generalized symbolic disorder or the result of a "disturbance at the semantic level of integration." In contrast, a disturbance of the reproduction of "conventionalized communicative movements" on the ideomotor apraxia measure was explained by the authors as "due to a true apraxic or executive defect and very seldom to poor comprehension of the gesture itself."

Several additional studies have also addressed pantomime recognition in persons with aphasia. Varney (1978) studied the relationship between a disturbance of pantomime recognition and performance on linguistic tasks. Because pantomime recognition is an input modality phenomenon, Varney chose to include tasks that would assess two receptive (input) language modalities: auditory comprehension and visual comprehension or reading. Varney reasoned that pantomime recognition was a visually mediated phenomenon; therefore, a visual or reading comprehension task would be essential to any investigation of the relationship between a disturbance of pantomime recognition and language disturbance in aphasia. Two groups of subjects participated: aphasic subjects (n=44) and control subjects (n=20). All subjects were administered three measures of linguistic function: visual naming (confrontation naming), aural comprehension (pointing to a pictured object named or described by the examiner) and reading comprehension (pointing to a pictured object in response to a printed word or description on a stimulus card). All three linguistic measures were subtests of the Multilingual Aphasia Examination (Benton, 1969). Performance below the fifth percentile relative to previously established norms was considered defective performance. Varney's pantomime recognition measure consisted of 30 indicative gestures (pantomimes depicting the use of common objects) administered from a videotape-television monitor arrangement. For each item, subjects pointed to a pictured object the use of which was pantomimed. Four choices for each item were arranged as follows: the target or correct choice (e.g., a saw), a semantic foil (an object belonging to the same class of objects as the target, like an ax), a regular foil (an object pantomimed elsewhere in the battery) and an odd foil (an object having a use which was not suitable for pantomime, like an oil well).

The correlation between the pantomime recognition and reading comprehension measures was higher ($r=.87$, $p<.05$) than between the pantomime recognition and aural comprehension ($r=.61$, $p<.05$) or naming ($r=.60$, $p<.05$) measures. Consequently, Varney concluded that the pantomime recognition and reading comprehension measures were "most closely" associated. Further analysis of the pantomime and reading measures indicated that all aphasic subjects (n=14) who performed at a "defective" level on the pantomime recognition measure (i.e., lower than the lowest scoring control) also performed defectively on the reading comprehension measure (i.e., below the fifth percentile). Twenty-two aphasic subjects who "passed" the reading comprehension test also "passed" the pantomime recognition measure. Four aphasics who "failed" the reading comprehension test "passed" the pantomime recognition measure. Fifty percent (13 of 26) of the aphasic subjects who "failed" the auditory comprehension test also "failed" the pantomime recognition measure. The results of Varney's study can then be summarized as follows: there is a "close" relationship between pantomime recognition and reading comprehension.

Impaired pantomime recognition was always associated with difficulty in reading comprehension that was generally of comparable severity. However, difficulty in reading comprehension was not always related to difficulty in pantomime recognition. On occasion, reading comprehension was more severely involved than pantomime recognition. Therefore, intact pantomime recognition was thought to constitute a necessary but not sufficient condition for intact reading comprehension. Varney concluded that there are at least two determinants of a disturbance of reading comprehension in aphasia: (1) a supralinguistic impairment, "asymbolia," which also affects nonverbal performance and (2) a specific linguistic impairment which only affects reading comprehension (i.e., a specific aphasic alexia).

Varney (1982) then investigated the relationship of pantomime recognition to measures of "cognitive performances." These measures of "cognitive performances" included the Sound Recognition Test (Spreen & Benton, 1974) which assesses the ability to recognize familiar, non-linguistic environmental sounds such as a dog barking or a train whistle, a letter recognition measure, the Block Design subtest of the Wechsler Adult Intelligence Scale (Wechsler, 1955) and the reading comprehension subtest of the Multilingual Aphasia Examination (Benton, 1969; Benton & Hamsher, 1978). Forty-four aphasic subjects participated.

"Defective" performance (obtaining a score below the fifth percentile relative to previously established norms) was observed for 18 of 44 subjects on the pantomime recognition measure, 22 of 44 subjects on the reading comprehension subtest, 19 of 44 subjects on the letter recognition measure and 19 of 44 subjects on the Block Design test. Seventeen of the 18 subjects who "failed" the pantomime recognition measure also "failed" the reading comprehension subtest.

This observation, that a disturbance of pantomime recognition usually co-occurred with a disturbance of reading comprehension (and not vice versa), led Varney to conclude that the disturbance of pantomime recognition is symptomatic of a specific aphasic alexia and not "asymbolia" or "loss of the abstract attitude." Finally, Varney hypothesized that pantomime recognition may very well be an ability that is preadaptive (in the evolutionary sense) for reading.

Table 1. Classification criteria for aphasia taxonomy used by Ferro, Santos, Castro-Caldas and Mariano (1980).

APHASIA TYPE		NAMING (16 objects)	UNDERSTANDING (8 commands)	REPETITION (30 words)
BROCA	Non-fluent	<16	≥7	<23
GLOBAL	Non-fluent	<16	<7	<23
WERNICKE	Fluent	<16	<7	<23
ANOMIC	Fluent	<16	≥7	≥23
CONDUCTION	Fluent	<16	≥7	<23
TRANSCORTICAL				
MOTOR	Non-fluent	<16	≥7	≥23
SENSORY	Fluent	<16	<7	≥23
MIXED	Non-fluent	<16	<7	≥23

Ferro, Santos, Castro-Caldes and Mariano (1980) studied the relationship between verbal and nonverbal performance in persons with aphasia. One hundred eleven persons with aphasia and 48 controls were administered measures of pantomime recognition, language, three-dimensional constructional praxis and both ideomotor and ideational apraxia. Aphasic subjects were categorized by type according to the classification system/taxonomy depicted in Table 1.

Using this taxonomy, 32 subjects were classified as having Broca's aphasia, 30 as global, 27 as Wernicke's, 10 as anomic, five as conduction and seven as transcortical (one as transcortical motor, three as transcortical sensory and three as mixed transcortical). The performance of 48 aphasic subjects was judged to be disturbed on the pantomime recognition measure. These subjects scored lower than the lowest scoring control. A significant relationship was observed between a disturbance of pantomime recognition and disturbed auditory comprehension. Subjects classified as Wernicke's, global and transcortical aphasics scored lower on the pantomime recognition measure than subjects classified as Broca's, conduction and anomic aphasics. The scores of persons classified as Broca's, conduction and anomic aphasics did not differ statistically from controls. The disturbance of pantomime recognition was also related significantly with the disturbance of reading comprehension but only in subjects with central alexia.[1] As well, a significant relationship was observed between disturbed pantomime recognition and both ideomotor and ideational apraxia, tested imitatively (theta =.40, $p<.05$ for both). The observation that 12 non-apractic aphasic subjects manifested a disturbance of pantomime recognition, coupled with the observation that only 36 of 57 aphasic and apractic subjects also manifested a disturbance of pantomime recognition, led the authors to conclude that "receptive" and "expressive" aspects of gestural or pantomimed communication are independent. The authors explained, "Our results stress the relative independence of verbal and nonverbal left-hemispheric activities and the importance of locus of lesion in nonverbal impairment. Most left posterior lesions, while determining auditory comprehension and reading defects, also produce gesture recognition disability..." (p. 290).

As part of the larger investigation, Duffy and Duffy (1981) replicated their 1975 study in which they investigated pantomime recognition in aphasia. In this later study, three groups of subjects, left-hemisphere damaged subjects with aphasia (n=47), right-hemisphere damaged subjects without aphasia (n=27) and controls (n=11), were administered the Pantomime Recognition Test (PRT); the Verbal Recognition Test (VRT), a measure of auditory word rec-

[1] Central alexia as defined in this study conforms with Damasio's (1977) description of the alexias. Central alexia is associated with disturbed performance on tasks of letter recognition, word identification (auditory word recognition) and word-object matching.

ognition; the Naming Test (NT), a measure of visual confrontational naming; and the Porch Index of Communicative Ability (PICA). The PRT used in this study was a 46-item version of the original 50-item PRT used in the 1975 study. Four items were deleted because they were found to lack discriminating power (as determined by item analysis of the original results). The results of this study corroborated the results of the authors' previous study and demonstrated (1) a disturbance of pantomime recognition in persons with aphasia and (2) significant correlations between the PRT and PICA ($r=.73$, $p<.05$), the PRT and VRT ($r=.73$, $p<.05$) and the PRT and NT ($r=.50$, $p<.05$).

Seron, van der Kaa, Remitz and van der Linden (1979) suggested that a plausibility factor, not of a linguistic nature, explains a disturbance of pantomime recognition in persons with aphasia. Twenty-seven subjects with aphasia and 20 controls were administered a 12-item pantomime recognition test. For each item, a line drawing of a person positioned to represent the use of a target object was depicted along with three vertically displayed object choices: the target object (e.g., a piano), a semantic distracter (i.e., an object related conceptually to the target, like a harp) and a morphological distracter (i.e., an object related in form but not conceptually to the target, like a desk). The plausibility of the distracters was determined by having 40 persons (20 males and 20 females) judge each line drawn person representing the use of a target object coupled with each distractor item. These judges then classified each distractor relative to the positioned person as "possible and usual," "possible but unlikely" or "impossible." In addition to the pantomime recognition test, subjects were also administered subtests from "L'examen de l'aphasia" (Lhermitte & Ducarne, 1965) as well as subtests from a French adaptation of the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass & Kaplan, 1972). Using the aphasia severity rating scale from the BDAE, the authors classified aphasic subjects as "light" (scores of 0,1 or 2) or "serious" (scores of 3, 4 or 5). Subjects were also categorized by type of aphasia. Fourteen subjects were classified as Wernicke's aphasia, nine as Broca's aphasia and four as global. Two comprehension scores were determined, one each for the auditory and visual modalities.

Significant relationships were observed between both auditory comprehension and pantomime recognition ($r_s=.48$, $p<.01$) and reading comprehension and pantomime recognition ($r_s=.64$, $p<.001$). The relationship between severity of aphasia and pantomime recognition was insignificant ($p=.104$) as was the relationship between type of aphasia and pantomime recognition (p-valve or alpha level unreported).

Comparing the results of plausibility classifications made by the 40 judges with type of error made by aphasic subjects, it was observed that the more a distractor was judged to be "impossible," the less often it was chosen by aphasic subjects ($r_s=-.70$, $p<.001$). The more the distractor was judged to be "possible and usual" or "possible but unlikely," the more it was chosen as the errored response by aphasic subjects ($r_s=.64$, $p<.001$ and $r_s=.58$, $p<.01$, respectively). Consequently, Seron et al. concluded that a plausibility factor not of a linguistic nature best explains a disturbance of pantomime recognition in persons with aphasia.

Two additional studies have suggested that a disturbance of pantomime recognition in persons with aphasia is perhaps a function of how response choices are depicted. Koller, Schlanger and Geffner (1975) administered two measures: an auditory action word-recognition measure and a pantomime recognition measure to 17 aphasic subjects. Both measures included the same 25 items. For the auditory action word recognition measure, subjects were required to point to the picture from four that depicted an action verbalized by the examiner (e.g., "throwing"). For the pantomime recognition measure, each subject was required to point to the action picture from four that demonstrated the action of the pantomime performed by the examiner (the first author). This action pantomime was presented from a videotape-monitor arrangement. Administration of the auditory action word measure always preceded administration of the pantomime measure.

Raw score data were analyzed using a t-test for paired samples procedure. A significant difference ($t(16)=2.04$, $p<.05$) was observed between measures with aphasic subjects performing better on the pantomime than on the verbal measure. Data were further analyzed by dividing aphasic subjects into two groups: "high" and "low" level, according to judgments of functional expressive communication ability. Using the Mann-Whitney U Test, differences between groups were not significant.

In another study, Daniloff, Noll, Fristoe and Lloyd (1982) investigated the ability of aphasic subjects to recognize Amer-Ind gestures. Fifteen subjects were divided on the basis of severity according to scores obtained on the Listening and Talking subtests of the Aphasia Language Performance Scale (ALPS) (Keenan & Brassel, 1975). Five subjects were placed in each of three severity categories: mild, moderate and severe. The authors sought to determine the influence on performance of both severity of aphasia and type of pictured response: the pictured target object or a pictured action using the target object. Two additional concerns were investigated as well: the relationship of Amer-Ind recognition scores to performance on the Listening and Talking subtests of the ALPS and the determination of the type of errored response occurring most often (i.e., choosing related or unrelated foils). For each item, subjects had the choice of the target, a related item or two unrelated items.

The authors found that aphasic subjects performed significantly better when the action pictures using the target object were depicted than when the pictured object alone was depicted ($t(14)=2.98$, $p<.01$). Severity of aphasia did not distinguish the groups. A moderate and significant relationship ($r=.59$, $p<.05$) was observed between performance on the Amer-Ind measures (actions, not objects) and the Listening subtest of the ALPS. Finally, errored responses chosen by the subjects were "overwhelmingly" related to the target than were choices that were unrelated to the target.

Wang and Goodglass (1992) investigated the comprehension of pantomimed movements in 30 aphasic and 20 normal control subjects. The authors sought to determine the relationship between a disturbance of pantomime and aphasia, apraxia or both. All subjects were administered a Pantomime Recognition Test (PRT), Transitive Pantomime Expression Test (TPET), Intransitive Pantomime Expression Test (IPET), Meaningful Movement Imitation Test (MMIT), Nonmeaningful Movement Imitation Test (NMIT) and measures of general intellectual ability (PIQ), language impairment and reading. The PRT required the subject to view a videotape and select from four the correct pantomime involving the manipulation of imaginary objects per-

formed one at a time. The four choices included the target, a semantic foil, a perceptual foil and an unrelated foil. The TPET evaluated the ability to express meaningful information (i.e., demonstration of the use of an object by pantomime). Fifteen pictures of objects were used and responses were scored using the following scoring system: fully adequate — 3 points, reduced — 2 points, minimal — 1 point and failure — 0 points. The IPET required each subject to produce pantomimes of intransitive actions on verbal command. Both conventional gestures (e.g., "show me how you salute") and representational pantomimes (e.g., "show me that it's too cold") were included. The MMIT included eight transitive and eight intransitive pantomimes and gestures selected from the TPET and IPET. These were presented via videotape twice each, one at a time, for imitation. The NMIT consisted of 16 movements recorded on videotape. These were displayed twice before subjects were required to imitate each. The items were matched in complexity with MMIT items and were designed by changing the direction or position in space of the matched items on the aforementioned test. This measure was used as a criterion for impairment of motor praxis. PIQ was determined from administration of the Picture Completion, Object Assembly, Block Design and Picture Arrangement subtests of the Wechsler Adult Intelligence Scale-Revised (WAIS-R). The score was prorated to compensate for deletion of the Digit Symbol subtest. Language impairment was measured using the mean percentile score for the four Auditory Comprehension subtests from the Boston Diagnostic Aphasia Examination (BDAE) and the Boston Naming Test. A composite score, the Language Impairment Index (LII) was determined. A reading comprehension score was determine from averaging percentile scores for each subject for performance on the reading comprehension subtests of the BDAE.

Analysis of errors on the PRT indicated that essentially equal numbers of semantically-based and percentually-based errors were made with fewer unrelated errors observed. Zero order correlation coefficients were calculated among the variables. The PRT correlated significantly with all measures except PIQ. Significant correlations ranged from .37 with reading to .73 with the TPET. Stepwise multiple regression analysis was then applied to further elucidate the results of the correlation analysis. The relationship between the PRT and the PIQ, the LII and the NMIT was examined with performance on the PRT being the independent variable. Step 1 of the multiple regression entered PIQ into the equation and accounted for nine percent of the variance of pantomime recognition. LII was added to the equation at Step 2 and uniquely accounted for 15 percent of the variance; together PIQ and LII accounted for 24 percent of the variance in pantomime recognition. Step 3 added NMI to the equation and accounted for an additional 30 percent of the variance; cumulatively PIQ, LII and NMI accounted for 54 percent of the variance in pantomime recognition.

Pantomime Expression in Persons with Aphasia

Perhaps the earliest systematic investigation of a disturbance of pantomime expression in persons with aphasia was conducted by Goodglass and Kaplan (1963). These researchers developed and administered a "gesture-pantomime" test containing 46 items which were divided among five gestural types. The five gestural types included were: natural expressive gestures (e.g., "show me how you would hold your nose when you smell something terrible"), conventional measures (e.g., saluting on verbal command), simple pantomimes — action with object but without using the object (e.g., "show me how you would eat corn on the cob"), object description (i.e., demonstrating the use of a pictured object) and complex narrative pantomime (e.g., having the subject observe the "acting-out" of a sequence of events performed by the examiner) then multiple choice verbal questioning regarding the pantomime, followed by re-enactment of the sequence of events by the subject. Only after the subject observed the examiner and was questioned regarding three such pantomimes was the subject required to re-enact each one.

Two groups of subjects, left-hemisphere damaged aphasic subjects (n=20) and non-aphasic, brain-injured controls (n=19), participated. Included in the control group were persons with etiologies described as cerebrovascular accident, traumatic lesions, post-operative brain tumor, post-encephalitic phenomenon and Alzheimer's disease. Two questions were addressed: (1) do persons with aphasia differ from controls (matched for age and intelligence) in their ability to use gesture and pantomime and (2) would such a difference, if observed, be explained as a central communication disorder? Subjects' performances were rated as "adequate," "partially adequate" and totally inadequate" by the examiner. Because the authors had difficulty determining whether or not poor auditory comprehension confounded performance on these tasks, all "totally inadequate" ratings were deleted from the analysis of data.

In addition to the "gestural-pantomime" test, the Boston VA Hospital Diagnostic Test (later to become the Boston Diagnostic Aphasia Examination) was administered primarily to rate severity of aphasia. The Performance portion of the Wechsler Adult Intelligence Scale was also administered as a measure of nonverbal intelligence. The results obtained from administration of this latter measure were used to assist in matching aphasic and control subjects relative to the nonverbal intelligence variable. To assess the ability of subjects to imitate gestures (not to be confused with complex narrative pantomime), the subjects first observed the examiner demonstrate selected natural and conventional gestures as well as simple pantomimes of actions with objects, then heard the examiner tell what was being demonstrated and observed the examiner's demonstration a second time. Descriptive notes were taken by the examiner subsequent to each subject's attempt at imitation.

The performance of aphasic subjects on this latter measure led the authors to conclude that the disturbance of gesture-pantomime observed in persons with aphasia is an apractic phenomenon secondary to damage to the left cerebral hemisphere. Their substantiation for this conclusion was on the basis that both performance on the "gesture-pantomime" measure and improvement of performance by aphasic subjects on the imitation-of-the-examiner task were inferior to that of age- and intelligence-matched controls.

Among the statistical analyses performed, rank order correlation coefficients were calculated to compare the relationship of severity of aphasia to the "gesture-pantomime" measures. The results of these statistical analyses were reported as follows: severity and gestures (r_s = -.26, $p>.05$); severity and simple pantomime (r_s = -.39, $p>.05$); severity and composite gestures and pantomime (r_s = -.36, $p>.05$), all insignifi-

Table 2. Correlation matrix of PICA and experimental test scores (after Pickett, 1974)

Comparisons between overall (OA) PICA score, PICA modality scores: Gestural (Ges.), Verbal (Vb.) and Graphic (Gp.) and Portions 1-6 (P_1 - P_6) of Pickett's battery. Coefficients are significant at the .001 level.

	OA	Ges.	Vb.	Gp.	Ges. &P_{1-6}	P_1 &P_6	P_1	P_2	P_3	P_4	P_5	P_6
OA	—	.94	.93	.88	.91	.90	.84	.86	.78	.89	.84	.77
Ges.	—	—	.90	.72	.92	.84	.85	.88	.79	.92	.83	.76
Vb.	—	—	—	.70	.86	.93	.83	.77	.68	.83	.82	.72
Gp.	—	—	—	—	.74	.72	.67	.70	.65	.69	.69	.66
Por. 1-6	—	—	—	—	—	.84	.92	.93	.84	.84	.94	.91

cant. Additional rank order correlation coefficients were calculated between Performance IQ and both simple (r_s = .48, p<.05) and complex (r_s = .56, p<.05) pantomime for aphasic subjects and between Performance IQ and both simple (r_s = .60, p<.05) and complex (r_s = .85, p<.05) pantomime for control subjects, all significant. In interpreting these results, Goodglass and Kaplan (1963) concluded further that pantomimic ability is "impaired-in direct relation to the loss of intellectual efficiency in brain-injured patients whether aphasic or otherwise" (p. 720).

In an attempt to further elucidate the disturbance of pantomime and gesture in persons with aphasia as an apractic phenomenon or a disorder related more with the severity of language disturbance in aphasia, Pickett (1972, 1974) developed and used a pantomime and gesture battery. Initially 25 control subjects were administered the Porch Index of Communicative Ability (PICA) (Porch, 1967, 1973) followed by Pickett's pantomime and gesture battery. This was done to standardize testing procedures. Next, 28 aphasic subjects were administered both the PICA and the pantomime and gesture battery. The pantomime and gesture test proper was comprised of six portions. The first portion (P_1) assessed the ability of aphasic subjects to demonstrate the use of a pictured object. The second portion (P_2) required that the subject demonstrate the use of an object placed in hand. Portion three (P_3) required the subject to select from 10 objects the object that was associated most with the functional position of a person depicted in a photograph. Portion four (P_4) required that the subject point to a picture of an object the use of which was performed by the examiner without the object. In the fifth portion (P_5), subjects were instructed to perform acts on verbal command (e.g., "pretend that you are smoking"). Finally, portion six (P_6) required that subjects imitate the pantomime performed by the examiner. All responses were scored using a 16-point multidimensional scoring system.

A strong, positive relationship was observed between PICA modality scores and all pantomime tasks (Table 2). In addition, the results from P_1, demonstration of the use of a pictured object, compared to P_6, imitation of a pantomime performed by the examiner, indicated that, indeed, the pantomimed performance of aphasic subjects improved on imitation of the examiner. Using t-test procedure, differences in aphasic subject performance between P_1 and P_6 were significant beyond the .01 level; the aphasic subjects performed better as a group on P_6, the imitation task. Pickett then refuted the conclusion of Goodglass and Kaplan (1963), that a disturbance of pantomime expression in persons with aphasia is best explained as an apractic phenomenon. He concluded, "Gestural ability is related to the overall severity of aphasia and is not independent of general communicative behavior" (p. 84).

Duffy and Duffy (1981) investigated both a disturbance of pantomime recognition and pantomime expression in persons with aphasia. Their results regarding a disturbance of pantomime recognition in persons with aphasia have been presented in a previous section. Their work addressing a disturbance of pantomime expression is presented here. Three groups of subjects, left-hemisphere damaged persons with aphasia (n=47), right-hemisphere damaged persons without aphasia (n=27) and controls (n=11), were administered, in addition to a pantomime recognition test, a verbal recognition test, a naming test, the Manual Apraxia Test (MAT) (Duffy, 1974), the Coloured Progressive Matrices (CPM) (Raven, Court & Raven, 1977) and the Porch Index of Communicative Ability (PICA) (Porch, 1967, 1973). A mean score of 8.30 obtained by aphasic subjects as a group on the pantomime expression measure differed significantly from both the right-hemisphere damaged group (M=12.40, p<.01) and the control group (M=12.30, p<.01). Coincidentally, both the right-hemisphere damaged group (RHDG) and the control group (CG) obtained identical mean scores; however, both the standard deviation (RHDG = 1.12; CG = .87) and the range of values (RHDG = 9.8 to 14; CG = 10.5 to 13.5) were larger for the RHDG. For the aphasia group, significant Pearson product-moment correlation coefficients were obtained between the pantomime expression measure and the pantomime recognition measure (r = .68, p<.01), the naming measure (r=.78, p<.01), the verbal recognition measure (r=.63, p<.01), the PICA (r=.89, p<.01), the MAT (r=.70, p<.01) and the CPM (r=.50, p<.01).

In addition to observing significant differences among groups for the pantomime expression and pantomime recognition measures, significant differences were also observed between the aphasia group and both the RHDG and the CG on the verbal recognition measure, the naming measure and the MAT but not for the CPM. Rank ordered, the aphasia group obtained the highest group mean score on the CPM (M=19.7) compared to the RHDG (M=18.9) and the CG (M=18.3) The aphasia group also had the largest standard deviation (SD=9.91) compared to the RHDG (SD=6.86) and the CG (SD=5.37) on this measure.

Data for the aphasia group were analyzed further according to partial correlation procedures and multiple regression analysis. First order partial correlation coefficients between the pantomime expression measure and the PICA were .81 and .85 when the MAT and CPM were controlled for, respectively. The second order partial correlation coefficient between pantomime expression and the PICA, controlling for both the MAT and CPM, was .80. These first and second order partial correlations were all significant at the .001 level. They decreased minimally in magnitude relative to the zero order correlation coefficient of .89 between pantomime expression and the PICA. The zero order correlation coefficient of .70 between pantomime expression and the MAT was reduced to .38 when the PICA was partialled out. Similarly, the zero order correlation coefficient of .50 between pantomime expression and the CPM reduced to -.07 when the CPM was partialled out. This latter correlation was insignificant re: the .05 level. Using multiple regression analysis, it was observed that the PICA accounted for 80 percent of the variance in pantomimic expressive performance. The MAT and CPM accounted for a mere additional three percent.

These results, as well as the results of Duffy, Watt and Duffy (1978), are submitted in support of the conclusion that a disturbance of pantomime expression in persons with aphasia is best explained as a central symbolic disorder. This central symbolic disorder is said to be manifested as a disturbance of both verbal and nonverbal symbolic function.

Wang and Goodglass (1992) investigated the production of pantomimed movements in addition to the comprehension of pantomimed movements in 30 aphasic and 20 normal subjects. As mentioned in the previous section addressing pantomime recognition, the authors sought to determine the relationship between a disturbance of pantomime and aphasia, apraxia or both. Subjects were administered measures of pantomime, praxis, language and intelligence. All subjects were administered a Pantomime Recognition Test (PRT), Transitive Pantomime Expression Test (TPET), Intransitive Pantomime Expression Test (IPET), Meaningful Movement Imitation Test (MMIT), Nonmeaningful Movement Imitation Test (NMIT) and measure of general intellectual ability (PIQ), language impairment and reading. A Language Impairment Index (LII) was ascertained from performance on language measures. Scores for auditory comprehension (AC), reading (Read) and performance on the Boston Naming Test (BNT) were used in statistical analyses.

Zero order correlation coefficients between the TPET and other measures were significant statistically ($p<.01$) for six of the measures (PRT, IPET, MNI, AC, LII and NMI) and ranged between .57 with the LII and .76 with the IPET. The IPET was correlated significantly ($p<.01$ or $p<.05$) with eight measures (PRT, TPET, NMI, BNT, AC, LII and NMI). Correlations ranged from .44 with the BNT to .76 with the IPET. Stepwise multiple regression analysis was used to elucidate the results of correlation analysis for the TPET. Step 1 of the multiple regression entered PIQ into the equation. The contribution of PIQ to the variance in pantomime expression was 10 percent. Step 2 entered LII into the equation and uniquely accounted for 18 percent of the variance; combined PIQ and LII accounted for 28 percent of the variance in pantomime expression. Step 3 entered NMI into the equation. NMI uniquely accounted for 42 percent of the variance. The three (PIQ, LII and NMI) cumulatively accounted for 70 percent of the variance in pantomime expression. A factor analysis was applied to the nine variables measured to identify any commonness among the variables or factors. Three factors were identified. Factor 1 linked all movement-related measures (NMI, TPET, IPET, MMI, PRT) and auditory comprehension. Factor 2 identified three language measures (GNT, Read and AC) and IPET and MMI, the latter two comparatively smaller in magnitude albeit significant. Factor 3 loaded only PIQ.

The results of the work indicated that all measures of pantomime recognition and expression were highly intercorrelated, as were the language measures. Auditory comprehension was the single language measure that was consistently and significantly related to the pantomime measures. No language measure was related to the imitation of nonmeaningful movement. The authors interpreted these results as suggesting that pantomime production and imitation share common factors with both praxis and auditory comprehension; pantomime requires the formulation of a concept to be communicated as well as the planning of a purposeful movement. As well, in view of the strong relationship between pantomime comprehension and the production of nonmeaningful movements to imitation, the authors suggest apraxia entails impairment of both the interpretation and production of purposeful movement.

SUMMARY

The consensus regarding pantomime recognition and pantomime expression in persons with aphasia, as a group, is that both are disturbed. The explanation for this disturbance remains polemical. Philosophy, perspective and the measures used, of course, enter into one's choice of explanation. Studies differed methodologically. Subject characteristics such as sample size, type and severity of aphasia varied among studies. The measures administered also differed. Differences were evident in the stimuli used, the depiction of response choices, mode of presentation and task complexity. Issues regarding standardization, normative data bases, reliability and validity for the "investigator-designed" tasks described are not exempt from question with justification. Consequently, it is not surprising that results differed.

Disturbed pantomime recognition has been found to be related to severity of language disorder in aphasia, disordered semantic integrative processing, alexia specific to aphasia, a plausibility factor not linguistic in nature and may be influenced by the depiction of response choices. Disturbed pantomime expression has been related to the severity of language disorder in aphasia, ideomotor apraxia and cognitive decline. The recognition disorder may or may not exist as a function of aphasia taxonomy; however, if it does, the performance of persons with Broca's conduction or anomic aphasia may be superior to persons with Wernicke's, global or transcortical aphasia.

Cognitive and linguistic viewpoints (Finkelnberg, 1870; Head, 1926; Jackson, 1932; Critchley, 1939) purport that the pantomimic disturbance in persons with aphasia is a reflection of an underlying disorder in symbolic recognition and expression. There exists in the person with aphasia an overall representational or symbolic disruption. This reasoning is consistent with the Association (between verbal and nonverbal impairment) hypothesis as well (Feyereisen & Seron, 1982). Certainly, the central symbolic explanation and perhaps, broadly, the semantic disintegration and alexia explana-

tions may be parceled within this paradigm. Proponents of the ideomotor apraxia explanation envision the disturbance as a manifestation of apraxia. This reasoning is perhaps more consistent with the Independence hypothesis which suggests that verbal and nonverbal communication systems are "independent." Geschwind (1975), among others, subscribed to this notion. He believed that the left hemisphere is dominant for both speech-language and learned movements. Goodglass and Kaplan (1963) observed that persons with aphasia not only performed less well than brain damaged controls but failed to improve gestural-pantomimic performance on imitation of the examiner. They concluded that this disturbance is apractic. More recently, Wang and Goodglass (1992) have concluded (1) that pantomime production and imitation share common factors with both praxis and auditory comprehension and (2) apraxia entails impairment of both the production and interpretation of purposeful movements.

The explanation regarding pantomimic disturbance in persons with aphasia is by no means simple. What has been provided is a review of the pertinent literature regarding a disturbance of pantomime in persons with aphasia. Subjects, stimuli used, data analysis and the conclusions drawn to explain the disturbance have been detailed. Further research with specific subject description, well standardized/disorder normalized measures across pantomime, hierarchically organized components of language as a function of both competence and performance, praxis and cognitive/intellectual function will elucidate better the explanation sought after by many expert researchers and clinicians alike.

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Bilingual Classroom Discourse Skills: An Ethnographic Study

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Speech-language pathologists (SLPs) in the schools and teachers repeatedly face the challenge of how to best provide services for students who are learning English as a second language (ESL). The issue is compounded when SLPs and school professionals must provide services to students from bilingual homes. One means of overcoming the communication (language barrier) is for bilingual students to employ code switching, or the alternation of two languages, as a bridge between the two languages they speak (Faltis, 1989). This paper reports the findings from a qualitative or ethnographic field-based study. The data were obtained via observations and taking of field-based notes over an extended period of time (i.e., repeated observations of variables across time). The study was conducted in the ESL classroom in a small community elementary school. The school and community are located in a rural area of southwestern Minnesota. Presently, the elementary school is 30 percent Hispanic/Latino (Amato, 1996). All of the students enrolled in the ESL classroom speak Spanish as their first language. The pragmatic or functional language categories generated from the field observations are the basis of this paper. The general code moves consisted of: questions, commands, feedback, reinforcement, informative, answering/responding, starting a lesson, ending a lesson, seeking clarification, speaking out loud and other code functions. A summary of the classroom-based language functions are discussed.

Speech-language pathologists (SLPs) in the schools and teachers repeatedly face the challenge of how to best provide services for students who are learning English as a second language (ESL). The issue is compounded when SLPs and school professionals must provide services to students from bilingual homes. Bilingualism is defined here as the ability to use two languages with varying degrees of proficiency and in different contexts (e.g., reading, writing, listening and speaking). Communication in English can be a major barrier for many ESL students. One means of overcoming the communication (language barrier) is for bilingual students to employ code switching, or the alternation of two languages, as a bridge between the two languages they speak (Faltis, 1989). Code switching in the classroom is obvious and unavoidable with bilingual children (Aguirre, 1988). Aguirre maintains that school professionals should regard code switching as examples of communicative strategies employed by students. Unfortunately the understanding of language alternation behaviors and classroom discourse is a phenomena still not well understood by many SLPs and teachers. Cheng & Butler (1989) have pointed out that

> Professionals in speech-language pathology have viewed the use, amount and types of code-switching as indicators for relative proficiency or, on occasion, as the lack thereof. Some practitioners view code-switching as a symptom of language deficiency (p. 293).

Thus, SLPs and teachers need to better understand the interrelationship of the languages used by the culturally and linguistically diverse (CLD) bilingual student as she/he acquires and develops communicative proficiency in the instructional language of English. In this article we discuss factors related to describing bilingual teaching behavior and in particular the results of an ethnographic observational study of functional classroom language, particularly code switched and code mixed language behaviors.

Language Alternation and the Bilingual Student

Language alternation is a normal, common and important aspect of bilingualism (Grosjean, 1982; Kamwangamalu, 1992; Pennington, 1995). For the bilingual student, the process of code switching (alternating of two languages) requires a non-random, sophisticated cognitive and linguistic manipulation of the two languages (Aguirre, 1988; Miller, 1984). Four classifications of bilingual speaking abilities according to language performances are mentioned by Brice and Nye (in press). These four categories consist of: (1) Bilingually Advantaged, (2) L1 Advantaged, (3) L2 Advantaged and (4) Bilingually Disadvantaged. To illustrate, suppose a child is attempting to communicate a seeking help request (e.g., "I need help with this assignment"). If she/he is able to provide the appropriate message in both the first language (L1) and the second language (L2), she/he might be considered Bilingually Advantaged. Communication in either language does not differ significantly, and the student is viewed as a competent communicator. The use of code switching or code mixing may also be present without any detrimental perceptions of their language ability. However, if the student knows the request in L1 but not L2, it may be said that she/he is L1 Advantaged and is viewed as a more competent communicator in the primary language (e.g., Spanish) than in the second language (e.g., English). Alternatively, if the student knows how to say the request in L2 (e.g., English) but not in L1 (e.g., Spanish), it may be viewed contrarily that she/he is a less competent communicator in the native language (L1, Spanish in this example). Either of these conditions would illustrate that a language lag in either L1 or L2 is present. A student in this classification would not necessarily present with a language disorder since she/he has exhibited pragmatic competency in at least one language. The student's performance on a standardized assessment normed on monolingual English speaking peers may be that the L1 (Spanish) Advantaged may not perform well within the expected parameters, while the L2 (English) Advantaged student may perform well. Given the nature of the standardized test, in effect the L2 Advantaged student may know the correct response while the L1 Advantaged student may be unable to express the concept verbally in English. It should also be strongly reinforced that use of alternation is not indicative of a language disorder in and of itself (Cheng & Butler, 1989; Reyes, 1995). Quite to the contrary. In fact, language alternation in the proficient bilingual speakers' discourse indicates their knowledge of the two languages including the semantic,

morphological, syntactic and pragmatic dimensions of both languages. We would argue that language alternation (e.g., code switching or code mixing) is an indication of a sophisticated user who exhibits a sound cognitive and linguistic functioning.

The last category of the bilingual performer, the Bilingually Disadvantaged, suggests that the speaker is deficient in comparable linguistic elements in both languages. The initial analysis might suggest that this is an individual who, when compared to normal aged peers in either language group, would not perform in the normal range. However, consider that the absence of expressive function does not necessarily mean that a language disorder is present. It may be the issue that a "deficiency" is due to a lack of adequate instructional opportunities, life experiences or communication interactions. In any event, intervention by either the SLP or classroom teacher is warranted with further assessment needed to define the nature and extent of the deficiency.

Language alternation can be divided into two linguistic categories, code switching (CS) and code mixing (CM) (Kamwangamalu, 1992). There is a difference of opinion in the literature as to whether CM and CS should be looked at as different phenomena (D'Souza, 1992; Sridhar & Sridhar, 1980; Tay, 1989). The prevailing view is that the two are not different and should be understood as variations of a unique process in language alternation. For the discussion of this paper they shall be viewed as a common phenomena.

METHODS

A qualitative ethnographic field based study was performed. Qualitative research is descriptive research. Hence, words are used to describe the findings instead of numerical data (Bogdan & Biklen, 1992; Glesne & Peshkin, 1992). The data that is gathered is obtained via observations and taking of field based notes over an extended period of time (i.e., repeated observations of variables across time). Validity of the data, or authenticity, is obtained through ethnographic triangulation (i.e., three separate data points of the observations). Ethnographic triangulation of this study was obtained by having two separate observers, collecting data over an extended period of time (resulting in multiple observations) and by conducting interviews with the teacher and teacher aide.

The study was conducted in the English as a Second Language (ESL) classroom in a small community elementary school. The school and community are located in a small rural area of southwestern Minnesota. Presently, the elementary school is 30 percent Hispanic/Latino (Amato, 1996). All of the students enrolled in the ESL classroom speak Spanish as their first language. As is typically found in many ESL classrooms, the students are transitioned into an all English inclusive classroom after two to three years of ESL instruction (Brice & Montgomery, 1996). Thus, their English skills are a major focus of content instruction.

The observations were gathered by two non-participant observers (i.e., with minimal intrusion) in the ESL classroom. The data were gathered over a period of four months. Seventeen separate visits were conducted by the two observers. Each visit was 150 minutes long for the first observer (two and a half hours) and 60 minutes for the second observer. An overall total of 38 hours and 10 minutes was observed. Non-formal interviews with the teacher and teacher aide were conducted over the period of the four months. A formal final exit interview was conducted at the end of the study with the teacher and teacher aide. A total of 1,654 codings for 1,573 utterances were obtained and analyzed. Eighty-one utterances were coded for more than one function.

The teacher was partially proficient in Spanish and the teacher aide was highly proficient in Spanish (Spanish was her first and native language). English was the language of most classroom instruction; however, Spanish was also noted in classroom instruction. In addition, numerous instances of language alternations (code switching and code mixing) of Spanish and English were noted.

The students were observed mostly in small group instruction. Since the ESL classroom follows a loose structure, the number of students in the classroom at any given time are only estimates of the class size. The class size ranged from five to 20 students. Up to three different sessions could be occurring simultaneously with the teacher, teacher aide and helpers. Small groups that were observed ranged from two to eight students. Classroom lessons varied from reading, writing, mathematics, social studies and history.

The data collected in this study were primarily linguistic. Language utterances were obtained from the teacher, teacher aide and the students during classroom times. Information about the context of the lessons, who the speaker was and the purpose of their message was obtained in the field notes. The linguistic data for this study was obtained from the first observer's notes. The first observer was a native speaker of Spanish and a certified speech-language pathologist with over ten years of clinical experience. The second observer was a regular classroom educator with over 25 years of experience in school classrooms.

The categories generated from the field observations are the basis of this paper. The 50 classroom language functions observed and noted will follow. Specifically, the pragmatic behaviors that were found in the classroom are the initial findings reported here.

The categories were generated after all the field notes were obtained so as not to influence judgments while the data were being gathered. The initial categories were coded by the primary author. The codes were summarized with categories later homogenized, deleted and/or redefined. The codings were also re-examined during a tallying of the behaviors. The primary author established definitions and examples from the codings with the third author. The definitions were formulated between these authors over four sessions for a total of 6-1/2 hours of coding. In addition, an internationally renowned external reviewer examined the codings and provided feedback (Pennington, personal communication). Thus, the validity and authenticity of the codings and subsequent functions have undergone the following: (a) process reliability (i.e., rater agreement obtained through dual coding of behaviors by two of the three authors), (b) ethnographic (i.e., field based) validity (i.e., the items were obtained through extensive and repeated observations over time) and content based validity (i.e., obtained through a review of the literature).

Classroom Language Functions

Fifty classroom language functions were generated from this study. The functions are categorized under more general headings (i.e., code moves). The general code moves consist of (listed in order of the most to the least number of functions and the total frequency of occurrence): questions, commands, feedback, reinforcement, informative, answering/responding, starting a lesson, ending a lesson, seeking clarifica-

tion, speaking out loud and other code functions. It should be mentioned that there exists overlap between some of the code functions. That is, one utterance can fill two different functions or purposes. Eighty-one of the 1,654 utterances were coded more than once. The differences between the functions can be subtle. For example, procedure questions can also fulfill an indirect task request or, when the teacher or aide cues the classroom that she/he is leaving, this can also be a personal statement. Also, when the teacher or aide gives the answer to a question, she/he may be checking on the student's level of vocabulary understanding. In addition, use of a rhetorical question and explanation may serve both functions. While some code functions may seem obvious, each fulfills the important function of maintaining balance and equilibrium in classroom lessons.

Questioning

Questions are one significant aspect of teacher instruction in traditional teacher directed classrooms (Mehan, 1979; Pennington, 1995; Sinclair & Couthard, 1975). Sinclair and Couthard (1975) state that elicitation is one of three main classroom language functions. Questions may serve varied purposes, used in a variety of contexts:

(1). Task question. This question directs the other person (e.g., student) to the task. It is a more global type of question than a procedure question. Examples:

a. Teacher, "Anybody want to read it?"

b. Aide, "M., qué buscas?" (M., what are you looking for?).

c. Student, "Tengo que leer esto Tina?"

d. Aide, "What are you looking for now?"

e. Teacher, "Do you want to take a math test?"

(2.) Rhetorical question. A rhetorical question does not truly seek an answer. The purpose of the question is to alert the listener to information that is to be presented. Examples:

a. Aide, "You know what? You need to leave a space for the answer. Vas a dejar un espacio, aqui vas a poner la repuesta" (You are going to leave a space; here you are going to put the answer).

b. Teacher, "What did we do with these names? We put them in alphabetical order."

c. Teacher, from a review of spelling words, "What is someone who likes to sing? (No pause) He is a good _____.

(3). Procedure question. This is a single action type of question. It implies that movement is to occur from one task to another. It is a question that implies that steps are to be taken. Examples:

a. Teacher, "What else? Wanna do something else?"

b. Teacher, "What are you supposed to do with them when you come into my room, M.?"

c. Aide, "Did you figure it out?" "Como se escribe?" (A switch to Spanish for emphasis).

(4). Asking permission. This question is where the person asking seeks to obtain authorization from another individual. Example:

a. Aide, "Can I use it?" (Asking M. to borrow his pencil).

(5). Factual question. This is similar to Bloom's (1956) knowledge question. It requires a simple answer. Examples:

a. Aide, "How much here? How much money?"

b. Aide, "What's the next story?"

c. Aide, from a reading activity, "Are they in the garage? They made a tent in the garage? How long did they play in the snowhouse?

(6). Comprehension question. This is similar to Bloom's (1956) comprehension question. The person needs to understand the information in order to proceed with the lesson or task. Examples:

a. Teacher, "What can we do at the beach?" (Note that the question is posed to students who are still at the language stage of processing and comprehending English).

b. Aide, from a mathematics counting lesson, "M., you counting? Well, what do you think? Do you have enough?

c. Aide, "Each book, cada libro es uno. Aqui tienes uno. (Each book is one. Here you have one). How many does Kyle have?

d. Aide, from mathematics lesson of using pictures of flowers for semi-abstract representations, "Vimos mas de estas o de estas flores? (We saw more of these or these flowers?) Okay, you put the Zinnias.

(7). Content question. The content question may follow a comprehension question or vocabulary question. It addresses information related to classroom content lessons. Examples:

a. Aide, "What language is 'mille lacque'?"

b. Aide, "Okay, which is less?"

c. Aide, "Cuantos nececitas para hacer?" (How many do you need to do?)

d. Teacher, "E., how do you make the 'O' sound?"

e. Aide, from reading lesson, "What do you think is a deer? Page 67."

f. Teacher, "What letters make the 'au' sound?"

(8). Vocabulary check. This question type addresses vocabulary understanding and use for students. Examples:

a. Aide, "Sabes que quiere decir 'team'?" (Do you know what 'team' means?)

b. Aide, "Te acuerdas lo que quiere decir 'less'?" (Do you remember what 'less' means?)

c. Teacher, from a vocabulary review lesson, "What is this word? No, this word? Harmful, como a dañar algo (like to hurt something). But which one can hurt the air? What is a hurt? You're _____. You're what? But what is it? You're hurt."

d. Teacher, "You got a different name for your grandmother don't you? Abuelita? (Grandmother?, used in diminutive sense)

(9). Information check. The function of an information check was identified by Guthrie and Guthrie (1987). Its function is to verify understanding by another in the classroom. With information check, the question is a simple check. The asker wishes to know if the message was conveyed and understood. Examples:

a. Teacher, "Oh, you made something at the beach. What is this? Castle. Sure?"

b. Aide, "A., no sabes como se llama?" (A., you do not know what it is called?)

c. Teacher, from a discussion regarding a student summer camp trip, "J., Do you want to go to the summer camp at Gustavus? Okay, J., Then this is what you need." Student, "A donde va ser? (Where is it going to be?) Teacher, "A (To, at) St. Peter. A (To, at) St. Peter. Is it St. Peter?"

(10). Higher level question. The higher level questions are taken from Bloom's (1956) taxonomy of application, synthesis and evaluation. Examples:

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a. Teacher, "What if I want to put your names in alphabetical order?"

b. Aide, from a reading lesson and discussion that followed, "How come they had to take the one they made in church, take it down? How come they had to take that one down?

c. Teacher, from a reading lesson where the teacher is now asking questions about opposites, "Do a star and circle have the same shape or different?

(11). Personal question. The personal question is one where the information is not strongly related to classroom content or procedures. For the teacher it is a non-pedagogical classroom question. Examples:

a. Student, "Now what is she going to do with it?"

b. Aide, A student comes into the room crying, "What happened?

c. Teacher, teacher shifts topics and asks the student, "Do you speak Spanish? Do you understand your father's English? Make him understand, possible? (possible?)"

d. Teacher, teacher shifts topic to talking about fishing, "Does your dad have a fishing license?"

Commands

Commands fall under the realm of requests. Requests are language acts which ask or command a response from others. Guthrie and Guthrie's (1987) request act parallels Halliday's regulatory function. Brice's (1992) function of affecting the listener through language is also akin to the function of commands.

(1). Direct task request. This is similar to Canagarajah's (1995) and Guthrie and Guthrie's (1987) function of giving directions or classroom or following procedures. The direct task request function is, however, more specific. Typically the teacher or aide asks students to perform a direct request. It is clear and obvious what the request is and who should carry it out. Examples:

a. Teacher, "M. You need a pencil."

b. Teacher, "E. is reading."

c. Aide, from mathematics lesson, "Thirty-four on here. Where is it? You need to write it down."

d. Aide, from mathematics lesson, "You need to put three and four here."

(2). Indirect task request. An indirect request alludes to the task to be performed. Examples:

a. Teacher, "Now everyone has to help me do our writing."

b. Aide, Student is off-task, "M., you counting? (also a redirection to the task)"

c. Aide, the students are waiting for another student before beginning a task, "We gotta wait for H. Look at your spelling words while we wait for H."

(3). Redirection to task. The student is off-task and needs to be redirected to the appointed task in progress. Examples:

a. Teacher, "E. E., you need to follow along."

b. Aide, "M., never mind. What is it?"

c. Aide, from a mathematics lesson, "How many tulips did you see? Count them. Mira (look) M. how many tulips did we see?"

d. Aide, "How about we do a little bit of math and then you can look at this?"

(4). Seeking response with a fill-in answer (cloze). The teacher or aide seeks for the students to complete the answer. She/he allows for a pause and gives clear indication that the students need to give a verbal response. A rise in final pitch and intonation also may accompany this feature. Examples:

a. Aide, "Once les quitas cinco son_____?" (Eleven take away five is____?)

b. Aide, "No. You remember when you count by five? Five, ten, ____."

c. Teacher, from a vocabulary review lesson, "What is this word? No, this word? Harmful, como a dañar algo (like to hurt something). But which one can hurt the air? What is a hurt? You're _____."

d. Teacher, "Do you know what enough means in Spanish? Ba_____." Student, "Bastante (enough)."

(5). Directing to lesson. This request is more specific than the direct task request. It is content based whereas the aforementioned is task-based. It is a prompt to the lesson. Examples:

a. Aide, "I think you're going to put three forward."

b. Aide, "You need to leave a space for the answer."

c. Aide, "You need to read. Just, just here N."

d. Teacher, "Wait, what do you do at a period? Stop, take a break."

e. Teacher, "First you write the base word here."

(6). Personal request. The personal request is a plea outside of task or classroom functions. Examples:

a. Student, "T., me puedes ayudar con esto." (T., can you help me with this one.)

b. Student, to another student, "Pues quites la mano de aqui." (Well, take your hand away from here.).

Feedback (Reinforcement)

Pennington (1995) and Phillips (1975) note that teachers may discipline students while code switching. Disciplining is one of the language intentions under the general heading of providing feedback and reinforcement to students.

(1). Reprimand. Pennington (1995) and Phillips (1975) both state that teachers may discipline students through code switching. Reprimands in this study are also a form of discipline and serve the same function. The reprimand is a verbal admonishment. Examples:

a. Aide, "Ella te dijo que trajera el papel" (She, the teacher, told you to bring the paper)

b. Aide, "When you don't know B. You need to ask us before you finish so you don't get them all wrong."

(2). Enticement (prompting, positive reinforcement). Enticement may take several different forms such as prompting or providing some positive reinforcement. The positive reinforcement is usually verbal and immediate. The purpose of the enticement is to keep students involved and going. Examples:

a. Teacher, "Oh, you made something at the beach. What is this?"

b. Aide, "How about one more, otro mas?" (another one?)

c. Aide, from a story listening task and answering questions, "Where does it tell her name? At the very beginning of the story who's talking?"

d. Teacher, "Okay, good, keep going."

e. Teacher, from a reading activity, "You can do it M. You can read along. Yes, everybody. Yes, everybody."

(3). Correction. A correction is usually immediate and takes the form of correcting mistakes. Examples:

a. Aide, "What is a wolf?" (Student barks.) "That's a dog."

b. Aide, "Nope these two are wrong."

c. Aide, "No, what about here?"

d. Aide, from mathematics lesson, "M., is that the same? Son iguales?" (Are they the same?) "Look at this one. Is that right? No, look. And this number is..."

(4). Acknowledgment (confirming, e.g., yes/no response). The acknowledgment is a type of feedback where the speaker (e.g., the teacher) confirms a response with words similar to "right, sure" or may provide feedback as to the correctness or truth-value of the response. Examples:

a. Aide, "You know what M., you need to fix these."

b. Student, "Oh yeah."

c. Aide, "J. Are you painting?" Student, "Yeah."

d. Aide, "Si, tres pajaros" (Yes, three birds)

e. Teacher, from a reading lesson, "He got caught in the vine. What makes the "au" sound? "Au, right."

(5). Reiteration. Gumperz (1982) Kamwangamalu and Cher-Ling (1991) have identified the function of reiteration for additional emphasis. In reiterations, the speaker repeats what was said for emphasis. It may be used for different levels: vocabulary reiteration (i.e., do you understand the word), comprehension reiteration (e.g., do you grasp the material, do you understand the instructions), task reiteration (e.g., do you understand the task) or content reiteration (i.e., do you understand the content or scope of the material). Examples:

a. Aide, "Why is he afraid of the ball. Tiene miedo (He is afraid). R., he is afraid of the ball."

b. Aide, "Dos y que? Two plus what?"

c. Teacher, from a reading lesson, "Do you have one of these in your house, en su casa?" (in your house?)

d. Aide, from mathematics addition lesson, "Three and six more M. Three and six more M. No, no fingers."

(6). Reiteration from other's statement. The speaker repeats what the other person has previously said in the form of a response. Examples:

a. Aide, "The ones that are wrong." Student, "Los que estan mal." (The ones that are wrong.)

b. Teacher, from a lesson on the U.S. Civil war, "The ship was called the Monitor. Student, "The ship was called, como se escribe (how do you write) 'called'?"

c. Teacher, "Do you want to take a math test? Do you want to P.? You haven't passed them all." Student, "No lo has pasado todo." (You haven't passed them all.)

d. Aide, a student is leaving the classroom and the discussion follows of whether she should take the book to continue doing her work as homework, "Well, what do you think A., should you take it?" Student, "Should I take the book?"

(7). Giving an example. Exemplars are used. It may involve giving more than one answer or multiple ways of dealing the material. Examples:

a. Teacher (practice spelling test), "Next one is people. Of all the people on the street. P-E-O."

b. Teacher, "What's this? Look. B-b-bump. Now you guys bump heads."

c. Aide, from mathematics lesson, "Oh, go like this eight and two more."

d. Aide, words are being reviewed that were misread, "Now you know what wound (past tense of wind) means? He took a piece of string and went around and around."

Informative

This function heading deals with information being disseminated. Canagarajah (1995) views classroom transmission as a classification for classroom code switches. Canagarajah defines classroom transmission as, "The conventional or established code for direct/explicit instruction in the classroom..." (p. 185). Thus, Canagarajah's "Content Transmission" code switching function is a process means of disseminating information. McCarthy (1993) believes that teachers, in planning and executing a lesson, decide how the lesson shall be carried out. That is, the teacher frames certain phases of the lesson by what words and phrases she/he uses. Thus, certain content aspects of the lesson may be code switched to enhance its delivery. Adendorff (1993) identified the general function of transmitting knowledge. Our general heading of "Informative" corresponds to the category of transmitting information.

(1). Declaration (commenting). The speaker provides a comment or point of view related to the task or lesson. Examples:

a. Aide, "Good, you're all finished."

b. Student, "I know hare, but I don't know how to spell it."

c. Teacher, "J. Lets work on your reading. Oh my, look at the clock. He doesn't need a break today."

d. Student, "I finished."

e. Student commenting about another student, "A. Tan poco ha acabado." (A. Has not finished as well.)

f. Student comes over and tells the teacher about space rockets and then goes and sits down, "Los que van al espacio, como los que van al espacio." (The ones who go to space, like the ones that go to space.) Teacher, "What's he talking about?"

(2). Explaining. Merritt, Cleghorn, Abagi and Bunyi (1992) identified the function of emphasizing main points in instruction. Their function serves as a content marker indicating key points in teaching. Teachers may emphasize key elements through explanation. Thus, Merritt, Cleghorn and Bunyi's function corresponds to explaining. Pennington (1995) identified the behavior of explicating ideas, whereas the teacher used language to explain new words, ideas or concepts. Her function is comparable to the function of explaining. Explaining involves detailed dissemination of information which may involve two or more facts or bits of information (i.e., the teacher gives more than one thought). Examples:

a. Aide, "What language is 'mille lacque' Do you know what that means? What does 'mille' (French word) mean? Mil (Spanish). 'Mille' (French) means 'mil' (Spanish). 'Lac' (French) means 'lago' (Spanish)."

b. Student, "Esto aqui es la tierra y aqui es el cielo" (This is the earth and this is the sky).

c. Teacher, "The blue whales are the largest. Can anybody find anything about the humpback whales? Here it is, the humpback whales."

d. Teacher, "Oh we have lots of deer in Minnesota. Baby deer are called fawns. In this picture they're pretending to look for deer."

e. Teacher, mathematics lesson, "Twelve. Think A., What goes into 12? When you go to the store and buy 12 eggs. What is 12? Dozen."

(3). Informative (content/task related). Phillips (1975) and Tay (1989) identified the

function of elaboration or expanding. Their function serves to augment utterances by the teacher. The informative function involves giving small pieces of information (i.e., one fact). Examples:

a. Student, "No, lo miro porque esta negro." (No, I look at it because it is black.)

b. Aide, "Si, tres pajaros." (Yes, three birds.) "She was telling me about three birds" (speaking to the teacher).

c. Student, to another student, "Copycheater." Aide, "A. The word is copycat."

d. Teacher, lesson on the U.S. Civil war, "The south attacked Ft. Sumter. Do you know what it means to attack?"

e. Teacher, "I'm going to go one by one. What is this one S.? All of these words are from your studies."

(4). Informative personal. Personal information less related to the task or classroom lesson is given. Examples:

a. Aide, "Ahorita vengo." (I shall return soon.) "I'll be right back."

b. Aide, discussing how there are going to be animals brought to the school the next day, "Mañana van a tener animales (Tomorrow they are going to have animals). No van a cobrar (They will not charge)."

(5). Giving the answer. The teacher or aide provides the answer to a problem or question. This function typically follows teacher or aide question. Examples:

a. Aide, "Te acuerdas lo que quiere decir." (Do you know what ____ means) less? "Menos."

b. Aide, "How many here? Cinco y uno mas." (Five and one more.)

c. Aide, answering yes/no questions to worksheet, "What are you going to say? Burro." (Mule.)

d. Aide, answering yes/no questions to worksheet, "What do you think that is, long 'u'? A. Long 'u'."

Answering/Responding

Several functions noted in the literature address similar aspects to answering and responding. Halliday's (1978) heuristic function personal function seeks to express oneself. Vejleskov's (1988) behavior of expressing one's feelings positively also shares some attributes with answering and responding. Brice's (1992) function of expressing oneself also follows the same theme, yet the latter functions deal only with personal aspects. Answering and responding also deals with content aspects and structuring lessons.

(1). Translating a response. The speaker translates a response previously said by the other person. This may involve a one-word translation especially when for example the teacher may ask a vocabulary related question. Examples:

a. Aide, "Do you know what near means?" Student, "Tocar (touch)."

b. Teacher, "Soon he would be richer than any king on earth. Entiendes, rey?" (understand, king?) "King?"

c. Aide, "What is bring?" Student, "Traer." (to bring).

d. Teacher, "Do you know what it means to attack?" Student, "Atacar?" (To attack? A false cognate response).

(2). Choral response. The group answer or responds in unison to the teacher or aide request. Examples:

a. Teacher, "They go fishing on the what____. They go fishing on the big water, _____. What?" Students, "Ocean."

(3). Answering out loud, talking out loud (without being called upon). The student answers without being called upon or volunteers the information without any call from the teacher. The teacher may prompt for an answer but does not directly call upon anyone. Examples:

a. Student, "Six. Me faltan dos." (I have two left.)

b. Teacher, "You got a different name for your grandmother don't you? Abuelita?" Student One, "I call my grandmother abuela." Student Two, "I call her chila or chata."

(4). Answering in response to other's question. Pennington (1995) has a similar function of answering questions in teacher fronted instruction. The function of answering in response to other's questions is very similar. Examples:

a. Teacher, "I think that's an antelope. What do you call it?" Student, "Chivo." (goat).

b. Aide, "Cual es mas grande M. 55 o 57?" (Which is bigger M. 55 or 57?) Student, "57."

Starting a Lesson

Teachers use language to prepare students for pre-class instruction or lessons (Canagarajah, 1995). Canagarajah identifies the function of opening the class. Starting a lesson is also similar yet details those aspects which allow for pre-class instruction.

(1). Lead statement. Canagarajah (1995) identified the language function of opening the class to prepare students for pre-class instructions or lessons. Lead statements serve the same purpose. The lead statement is found at the beginning of a lesson. It distinctively cues the listener as to what is to occur. The teacher or aide proceeds in a verbal hand-holding with the students being lead along. The examples given provide the first step and lead to the next statement or step. Examples:

a. Teacher, "First grade lets get started."

b. Aide, "Okay, let's go. You ready?"

c. Teacher, "Here we go. Little Bear and Owl." (the name of the book they are to read).

d. Aide, "Okay, lets go do a little bit of math and then you can look at this M."

e. Teacher, "J. Lets work on your reading."

(2). Shifting topics. Brice (1992) noted the function of indicating topic shifts or a change in topic. Shifting topics in the classroom was found in this study. The class lesson was in place, and the teacher or aide moved to a new lesson. This involved a transition to a new lesson or aspect of the lesson. Examples:

a. Teacher, "You can take out your reading books. We're going to do the story about the star."

b. Teacher, "Okay, maybe we better put down our books down and get our workbooks out."

c. Teacher, "Okay, can you put your books away. I'm going to do a little poem here. Okay, I'm thinking of something. We're going to play a little game."

d. Teacher, "Get ready for your test."

(3). Starter-filler. Gumperz (1982) noted the use of an interjection to mark a sentence in code switching. Use of words such as "okay", "uh-huh", "a ver", "pues" as seen in conversation do act as interjections, starters or fillers. As a starter, the word serves to alert the listener that new or important information is to be given. Merritt, Cleghorn, Abagi and Bunyi (1992) identified the function of attention getting or focusing devices by teachers to procure classroom attention. As a filler, words like "okay"

indicate that the speaker is processing information or that she/he may still be holding the conversational floor. Examples:

a. Aide, "Okay, tu tienes que poner partes, fraciones." (You have to put parts, fractions).

b. Aide, "M. won. Okay, everybody pick up the bears."

c. Student, "A ver (lets see), Mississippi."

Ending a Lesson

The teacher expedites completion of the lesson through overt cues to the students. Pennington (1995) noted that the function of expediting a lesson could be achieved by switching to the dominant language. Ending a lesson is similar in overall function.

(1). Cuing to leave. The person gives information that it is time to leave and transition out of the classroom. Examples:

a. Teacher, "Know what,? Everyone put away your books. It's time to leave."

b. Aide (speaking to the teacher), "These guys gotta go back now."

c. Aide, "A. Its time to go."

(2). Cuing to finish. Pennington (1995) mentions that teachers in an effort to finish classroom lessons may switch to the dominant language. Cuing to finish is similar in that code moves are attempted to alert the student about finishing the lesson. Specific information is given which terminates or brings the lesson to a close. Examples:

a. Teacher, "Know what? Everyone put away your books. It's time to leave."

b. Teacher, "Okay, let's put everything away."

c. Teacher, "You know we have time for one more. Nine and ten are your homework."

d. Teacher, "Okay, you can put your books away."

(3). Departures. A departure saying is given, such as "goodbye." Examples:

a. Aide, "I have to go to dinner now. I have to go. See you later."

b. Student, "Bye, see you later."

Seeking Clarification

Guthrie and Guthrie (1987) and Torres (1989) have described the function of seeking clarification as one means of gathering information and facilitating understanding.

(1). Clarification. In clarification, the speaker seeks to define and illuminate upon some information. Brice's (1992) behavior of cuing the listener regarding topic shifts has some commonalities with clarification. Examples:

a. Aide, "Que quieres?" (What do you want?)

b. Aide, "What is the problem?"

c. Student comes over and tells the teacher about space rockets and then goes and sits down, "Los que van al espacio, como los que van al espacio." (The ones who go to space, like the ones that go to space). Teacher, "What's he talking about?"

d. Student One, "Miss, I have purple on my two feets." Teacher, "What?" Student One, "On my two feets." Teacher, "On your shoes?" Student Two, "Los tiene negro (She has them black, they are black)." Teacher, "Oh, your legs. Oh, bruises."

(2). Translating. Simple translation allows teachers to translate words and concepts from one language to another (Guthrie & Guthrie, 1987; Fitch & Hopper, 1983; Pennington, 1995). In translation, information in one language is to be transferred to the other via oral or written modes. Examples:

a. The Aide is translating a story directly from the written English to spoken Spanish. "Entonces, Henny Penny se fueron a la carrera a avisarle al rey que se va caer el cielo."

b. Aide, "Do you know what this word means, town? Que es en español? (What is it in Spanish?)"

(3). Seeking help. Canagarajah (1995) noted the function of requesting help. The student seeks assistance in order to perform an activity. Seeking help may take direct or indirect forms. Examples:

a. Student (direct), "Hey, Mrs. E., Mrs. E."

b. Student (direct), "T. Me puedes ayudar con esto?" (T., can you help me with this?)

c. Student (indirect), seeking help, "Yo no, le entiendo a esto." (I don't understand this.)

Speaking Out Loud

Diaz and Klingler (1991) refer to the function of private speech or the overt use of language and speaking during cognitive tasks. This overt language use is used to plan, guide and monitor the use of language. The function of speaking out loud is similar, but includes both practicing and planning functions.

(1). Self-talk. No teacher or aide prompt is given for the person to engage in self-talk. Unlike answering out loud, self-talk is not in response to a question. Examples include:

a. Student, "Now, I gonna try it out. Let me see how many words I get."

b. Student is counting out loud with no prompts, "1, 2, 3, 4, 5, 6, 7. Yo lo se." (I know it.)

2. Practicing. In response to the teacher or aide example, the student practices a response. For example:

a. Aide, "What's this? Look. B-b-bump. Now you guys bump heads." Student, "B-b-b."

b. Teacher, "In this picture they're pretending to look for deer. What's pretending?" Student, "Pre-pretender."

Other Code Moves

This consists of a general category of functions not identified by headings. However, the first three functions (we code, anticipation code switching and diglossia) are peculiar to language alternation.

(1). We code. Establishing rapport is a code switching function commonly cited in the literature as to why language alternation occurs (Gumperz, 1982; Guthrie & Guthrie, 1987; Kamwangamalu, 1992; Pennington, 1995, Pfaff, 1979; Poplack, 1980; Tay, 1989). Gumperz has referred to this rapport function as a "we code" (i.e., an in-group code) in which the mother tongue serves to establish solidarity. This function or "we code," adopted and borrowed from Gumperz (1982), may serve as an "elite" or "in-crowd" code which separates others from the interaction (Kamwangamalu, 1982). It may be found in individual talk among students, with teachers or in discussion of serious matters (Pennington, 1995). The "we code" may involve more personal and less school related topics (Timm, 1975). In addition, teachers may use the "we code" to motivate students (Pennington, 1995). Gumperz (1982) notes the personalization function wherein the speaker, as a consequence of becoming very excited, alternates to her/his most comfortable language and a "we code" switch results. Examples:

a. Aide, "Do you know what snore is?" Student, "Roncar." Aide, "No me gusta."

b. Aide, "Esta bien, its okay."

c. The teacher goes to get another student. Student 1, "Ella no tiene una agujera abajo". (She doesn't have a pierce below). Student 2, "El mio si. Mira B." (Mine does. Look B.)

d. Aide, a man comes into the room and starts talking with the aide. She then turns to the observer and states switching to Spanish, "El es mi hijo (he is my son)."

e. Student talking with another student as she leaves the room, "A las once si, acuerdarse mujer.' (At eleven, remember woman.)

(2). Anticipation code switching. The speaker anticipates a code switch. Mahecha (1990) mentions the issue of phonological anticipation of a code switch (i.e., that bilingual speakers are sensitive to pre-switch phonetic cues and are similar in their ability to perceive them). Accordingly, the pre-switch cues were affected by which language was being heard. Anticipation code switching may be the same phenomena, albeit at a lexical level. That is, speaking Spanish, for example, may trigger a switch to that language. Examples:

a. Aide, "Mask, drum, worm. Know what worms are? Do you know in Spanish? Sabes ques es?" (Do you know what it is?).

b. Student, "I'm forgetting my Spanish. Se me olvida mi español." (also a reiteration)

(3). Diglossia. Specific words for specific contexts may be used (Grojean, 1982). The words do not appear to be borrowed words since both the Spanish and English equivalents are used interchangeably, the words do not fill particular linguistic niches, and the particular diglossic words seem to reflect school subjects. Examples:

a. Student, "Se me revantaron six." (Six burst).

b. Student, "Phonics book ya lo se." (Phonics book now I know it).

c. Student, "Cuantos cumplo? Uno me falta. Fifty." (How many more do I need. I need one more. Fifty.)

d. Student, "Vas a poner (You are going to put)the ship. The ship was called, como se escribe (how do you write) 'called'?"

(4). Apologizing. The persons excuses or makes amends. Examples:

a. Student, "Vamos a ver el mapa de color, sorry" (Lets see the color map, sorry).

(5). Reading. This is a general category involving all reading, writing and literate aspects of language. Reading and literate aspects of language are an integral part of school learning. Although not the same function, Pennington (1995) has noted the role of reading in the first language in her study. Examples:

a. Teacher is reading a book, "Ronald Morgan goes to bat (also the name of the book). Is Ronald Morgan a good player?"

(6). Turn-taking. Turn-taking is verbalized. Examples:

a. Aide, "Okay M., your turn."

b. Student, "Let me try. Let me try."

c. Student, "Let me see."

d. Aide, "What is rolled? S. Your turn."

DISCUSSION

Classroom discourse research has identified some language categories used to classify language behaviors through use of ethnographic observations and codings (Adebdorff, 1993; Aguirre, 1988; Canagarajah, 1995; Guthrie & Guthrie, 1987; Merritt, Cleghorn, Abagi & Bunyi, 1992; Pennington, 1995; Phillips, 1975; Tay, 1989). Research identifying more specific classroom aspects in detail, such as Pennington's (1995) research, has been sparse. Use of ethnographic observation samples is known to be time-consuming. Speech-language pathologists have not been prone to using them. Most school speech-language pathologists do not have sufficient time to devote to gathering, analyzing and interpreting an ethnographic language sample. It my be that observations specifically addressing the language needs of bilingual students and Latino students have not been carried out with speech-language pathologists in mind. Hence, the need for descriptive data of Latino students in bilingual classrooms exists.

The 50 language functions described within this paper are common occurrences of language in the classroom and in particular the ESL classroom. The use of questions, commands, providing feedback and giving information were among the major types of language use observed in this study. Sinclair and Couthard (1975) and Mehan (1979) found the common uses of classroom language to focus around directives (commands), informatives (same category label for this study) and elicitations (questions are highly used to elicit information from students). Hence, it appears that the language functions observed in this study's bilingual classrooms corresponds with results of earlier research.

The languages of choice for instruction and personal use in this study were English, Spanish and a code-switched/mixed variety. One observation made during this study is that code switching and code mixing are a normal and natural occurrence whenever two languages co-exist and should not be viewed by SLPs as indicators of a language disorder in and of itself (Cheng & Butler, 1989; Reyes, 1995). Code switching/mixing was observed in all major code moves (e.g., questioning feedback, commands, etc.) by the teacher, aide and students in formal and informal language interactions. Hence, it is a natural sequela of bilingual environments and in most instances is an example of high level language usage.

The use of the language functions by teachers in addition to speech-language pathologists allows for a wider range of behaviors to be observed and noted. It adds to a more extensive data-base upon which staffing decisions for the school-based speech-language pathologist may be made. If teachers and SLPs know which behaviors to observe, then a systematic and natural inquiry of that student's language performance in the classroom is possible. Multiple observations of the same student by the teacher and speech-language pathologist may yield a more reliable estimate of the student's pragmatic and language abilities than typical standardized testing. In addition, the type of language used and the language demands of the ESL classroom should be noted by SLPs when assessing and carrying forth individual education plans.

Collaboration with ESL teachers furthers the educational needs of the bilingual Latino students. It also brings other professionals (e.g., the ESL teacher) into the assessment process. These features have often been neglected by speech-language pathologists working in schools.

Pragmatics and classroom language performance of various student groups (i.e., speech-language students and bilingual students from various language backgrounds) may be compared using the mentioned taxonomy of classroom language behaviors described herein. This information should

assist in determining if pragmatics problems exhibited by the bilingual student result from either a true language disorder or from a second language and acculturation delay. Use of such language functions as noted in this study may make this distinction possible.

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Disordered Cuban Spanish and American English Phonology

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The presence of culturally and linguistically diverse individuals in the United States has increased significantly. Speech-language pathologists who are unaware of Spanish phonological development may misinterpret student performances and be unable to provide an appropriate diagnosis and treatment. Knowledge of normal and disordered Spanish phonological processes is necessary for today's speech-language pathologist. Unfortunately a paucity of studies dealing with disordered Spanish phonology exists. The purpose of this paper was to examine disordered Spanish and English phonological skills in two groups of young Spanish and English speaking children in south Florida. Specifically this study compared disordered English versus disordered Cuban Spanish phonology. Combined results of two groups indicated differences in the frequency-of-occurrence for syllable reduction, pre-vocalic singleton omission, post-vocalic singleton omission, strident deficiencies, /r/ deviations and nasal deviations. Many group differences (as indicated in this sample) on the Assessment of Phonological Processes (Revised or Spanish) *may be attributed to phonological variations in dialect.*

The presence of culturally and linguistically diverse students has increased significantly in the United States. Speech-language pathologists who are unaware of Spanish phonological development may misdiagnose client performance and be unable to provide the most appropriate treatment (Brice & de la Paz, 1994; Goldstein, 1995). Goldstein stated that,

> Due to a lack of information on phonological acquisition in the Latino population in general, and across the various Spanish dialects in particular, speech-language pathologists face a difficult task in providing appropriate diagnostic and intervention services to Spanish speaking children (p. 18).

Knowledge of Spanish, Spanish versus English phonetics, Spanish versus English phonology, dialects of Spanish, normal Spanish phonology and disordered Spanish phonology is invaluable to the speech-language pathologist working with this population. The purpose of this paper is to review information pertinent to the aforementioned topics, then to compare disordered Spanish and English phonology in two groups of Spanish and young Spanish and English speaking children.

Spanish versus English phonetics

Stockwell and Bowen (1965) classify Spanish as having a simpler consonantal system than English. Spanish has 19 consonants which includes two semivowels, while English has 24 consonants including two semivowels. In English all syllables must have a vowel with the exception of syllabic consonants (Cook, 1996). Spanish consists of 42 phonemes with 19 consonant phonemes (Navarro, 1968). English has about 45 phonemes. The number of phonemes depends on the dialect and accent used (Cook, 1996). The vowel system of Spanish is considered less complex. Vowels do not significantly vary from one position to another as occurs in English: Spanish contains only five monophthong vowels, while English contains 13 monophthong vowels (MacKay, 1987). Spanish vowels occur in stressed and unstressed positions, while in English only one vowel occurs in an unstressed position (i.e., the schwa /ʃ/). Vowels in English may be preceded or followed by one or more. Differences in unstressed English vowels do not distinguish one word from another as consonants do in Spanish (Hadlich, Holton & Montes, 1968). Spanish stress has only two stress positions (i.e., primary and weak or absent). English can be said to have four stress positions: primary, secondary, tertiary, weak or non-stress (Dalbor, 1969). Spanish stress is louder than English stress and corresponds more to the English tertiary stress.

The Spanish phonemes /t, d, n, l/ are produced more anteriorly than in English approximating dental or interdental positions (Navarro, 1968). The Spanish /r/ consists of a tap (sometimes referred to as a flap which approximates a stop in occlusive features) and the trill is a vibrant (i.e., the tongue vibrates). The American Spanish /s/ (Spanish spoken in the Americas as opposed to the Castilian /s/ of Spain) is quite similar to the American English /s/, however the American Spanish /s/ can be aspirated. This is quite common in many American Spanish dialects (e.g., "mas" —> /ma^h/).

Spanish Versus English Phonology

Children speaking different languages will most likely show the same kinds of process development in their different languages (Cook, 1996). Natural processes do capture some general truths about development (e.g., that fricatives are harder than nasals or stops for children to acquire) consonants in syllable onsets are easier than syllable codas, etc. (Stampe, 1979). However, the form of these processes differs from language to language and the differences are determined by the language itself.

English and Spanish phonology also differ on certain aspects of development and use. English dialects are primarily affected by vowel differences, while some Spanish dialects (e.g., Mexican, Puerto-Rican, vs. Cuban) are noted in consonantal changes seen in fricatives, liquids, and nasals (Goldstein & Iglesias, 1996).

The length of syllables is relatively constant in Spanish. Bowen and Stockwell (1960) stated that "all syllables are either one or two units long..." (p. 25). Thus, intervocalic consonants in Spanish may be very important (Hammond, 1989). Hammond (1989) discusses this issue further. Spanish may also have many more assimilation processes (Hammond, 1989). In Spanish assimilation is particularly evident in nasal phonemes (Hadlich, Holton, & Montes, 1960; Harris, 1969). Terrel (1989) argued that "consonants may be articulatorily weakened, resulting in various

sorts of substitutions and assimilations" (pp. 205-206).

English may place more focus on stress and timing, while Spanish may be more syllable focused. Hadlich, Holton, and Montes (1968) stated that, "Spanish is said to have *syllable-timed rhythm*. Languages like English, which has syllables of unequal length dependent largely on the number and placement of stresses, are said to have *stress-timed rhythm*" (p. 202). Terrel (1989) stated that, "Spanish syllables tend to be almost equal in length and Spanish speakers never use an *uh* sound" (p. 210). Thus, Spanish avoids an uneven rhythm and heavy stress as does English. Spanish also tends to produce tense sounds at the beginning of syllables and lax sounds at the end of syllables, hence syllable initial sounds are salient, while syllable final sounds are less salient (Bjarkman, 1989; Hammond, 1989; Hooper, 1976). Tense sounds are produced with considerable muscular force and tension. For example, "busque" may become "buque" in the Cuban Spanish dialect. Bjarkman (1989) noted that the entire coronal series /t, d, *f*, n, s/ is weakest for Spanish and is strongest for English. Hence, the coronal sounds in some dialects of Spanish will tend to be deleted in syllable-final or word-final positions.

Most English words and syllables end with consonants, while Spanish syllables and words tend to end with vowels. Eblen (1982) stated that, "In Spanish [i.e., American Spanish], /s/ and its allophone [*z*] are the only fricatives allowed in word-final position" (p. 210). The sounds of /x/ and /*f*/ may also occur in some Spanish dialects in the final position. The few Spanish words that end with non-fricative consonants tend to be nasals, /r/ and /s/. English has 24 consonants that may end in the syllable final position. In English the voiced "th", /*f*/ tends to occur with high frequency as evidenced in demonstrative and article function words (the, this, that, there, those), while the Spanish /s/ is a high frequency occurring sound found in single syllables and function words (e.g., los, las, ellos, ellas, estos, estas) (Nash, 1977).

English has many true consonant clusters while Spanish does not have many true consonant clusters. The consonants that are contiguous are consonant sequences, however they typically occur at inter-syllabic boundaries (Stockwell & Bowen, 1965). For example in the Spanish word "estampa", the consonant sequence of "st" is not a consonant cluster (es/tam/pa). A deletion of the /s/ would be a post-vocalic omission and not a consonant cluster reduction.

Some phonemes occur in Spanish that do not occur in English. For example, Spanish has the tap /r/ and trill /rr/ phonemes (e.g., para, decir, tronco). The tap /r/ is a fricative, while the trill /rr/ (e.g., parra, rapido) is a vibrant (Canfield, 1981). Neither the trill /rr/ nor the /x/ (a velar voiceless fricative) occur in English. Spanish contains certain voiced fricative phonemes which are allophones of their respective voiced stop consonants (e.g., /b, ß/, /d, *f*/, /g, v/) (Bjarkman & Hammond, 1989).

Dialects of Spanish

Eblen (1982) revealed that some variations in adult Mexican Spanish phonology models can be attributed to dialectal differences. These variations are not disorders of phonology when the adult model also displays the phonological process. For example, in Mexican Spanish the syllable final /s/ may be deleted. Deletion of the syllable final /s/ has been noted to be characteristic of Spanish in the Caribbean (Eblen, 1982; Hammond, 1989). Eblen (1982) concluded from his study of six Mexican Spanish that substitution of /tV/ for /s/ made up 34 percent of all substitutions, /s/ deletion accounted for 28 percent of the total and substitutions of stops for fricatives (stopping) accounted for 28 percent. Eblen (1982) stated that "children learning a particular language are constrained by the dialectal allophones of their community, exhibit some patterns documented for many languages, yet show individual patterns in their attempts to produce adult forms of phonemes in their language" (p. 217). Thus, children normally copy the adult phonological variations of a language (expressed as a dialect), yet children can be apt to show true phonological errors.

Hammond (1989) noted certain phonological variations of Caribbean Spanish. The well documented phonological processes taken from Hammond included: (1) syllable-final and word-final aspiration or deletion of /s/, (2) /r/ and /l/ substitutions which can occur in syllable-final and word-final positions, (3) general word-final consonant deletion, (4) word-final /n/ velarization, (5) vocalization of word-final liquids and (6) phonetic alteration of /tV/ and /V/. Lesser known processes of Caribbean Spanish include: (1) vowel nasalization following nasal consonant deletion (perhaps related to vowel elongation following consonant deletion as noted by Hammond, 1989), (2) flapping (trilling) of intervocalic /d/ (i.e., /d/ —> trill /rr/), (3) sonorant devoicing, (4) word-final vowel devoicing and (5) consonantal germination (doubling of consonantal sounds).

Hammond (1989) stated that in "Cuban Spanish any syllable-final or word-final /s/ may optionally be deleted. In syllable-final environments *within a word*, however, whenever /s/ is deleted an obligatory phonological rule of compensatory vowel lengthening must also occur..." (p. 140). Hammond (1989) also stated that, "In all Caribbean dialects of Spanish, it has long been known that the phoneme /s/ may optionally be aspirated or deleted in syllable-final position within a word or in word-final position" (p. 38). The feature of deletion does apply to other sounds. Bjarkman (1989) stated that the /d/ phoneme is most commonly deleted sound in rapid, intervocalic speech. He supports this by stating, "Final /d/ in Spanish (*usted, edad, verdad, Madrid, etc.*) has weakened audibility for most dialects; *pasao* for *pasado* 'past' and *soldao* for *soldado* 'soldier' are not uncommon for most Spanish speakers" (p. 124).

Studies of normal Spanish phonology

Five different studies between 1983 and 1996 investigated the normal phonological processes of Spanish-speaking children from the ages of two to four (Diamond, 1983; Goldstein, & Iglesias, 1996; Martinez, 1986; Rivera-Umpierre, 1988; Paulson, 1991). Diamond (1983), Martinez (1986), and Paulson (1991) used young Mexican-American children in their studies, while Rivera-Umpierre (1988) and Goldstein and Iglesias (1996) studied the phonology of Puerto Rican Spanish-speaking children. The percentage of occurrence errors for these studies indicated the following processes to be the most commonly occurring: (a) /r/ deviations, (b) consonant sequence reduction, (c) /l/ deficiencies, (d) post vocalic omission, (e) strident deviations,(f) velar deviations and (g) glide deviations. According to data from Eblen (1982) and Hammond (1989), Spanish dialect can affect the phonological processes of postvocalic omission, strident

deviations, velar deviations, /r/ deviations (the Spanish tap and trill phones are different from the English /r/ and thus phonological interference between Spanish and English may be occurring), and possibly consonant sequence reductions.

Studies of disordered Spanish phonology

Review of the literature revealed that four studies have addressed the issue of disordered Spanish phonology (Goldstein, 1995; Meza, 1983; Stepanoff, 1991; Villanueva, 1991).

Meza (1983) studied 20 Spanish-speaking Mexican American, children from southern and Baja California. She examined four phonological categories: (1) segment omissions, (2) class deviations, (3) substitution processes and (4) miscellaneous error patterns. The results were analyzed according to percentage-of-occurrence errors for segment omissions and class deviations. Frequency-of-occurrence data were reported for the remaining two categories, namely substitution processes and miscellaneous error patterns. Her findings indicated that /r/ deviation was the most frequent error process, while consonant sequence reduction was the second most prevalent error process. Class deficiency processes with strident phonemes, /l/ liquids, and postvocalic singleton omissions followed in order of prevalence. Nasal assimilation (e.g., *lengua*—> /nenna/), alveolar assimilation (e.g., *bicicleta*—> /bisiteta/), labial assimilation (e.g., *fuego*—> /webo/), velar assimilation (e.g., *radio*—> /jajo/) and palatal assimilation (e.g., *cuchara*—> /tVutVara/) were the most prevalent substitution processes. Meza found that the means for the above mentioned phonological processes were above 50 percent.

Goldstein's 1993 study (cited in Goldstein, 1995) examined the disordered phonological speech of three and four year old (from 3:1 to 4:8) Puerto Rican Spanish-speaking children in Philadelphia, Pennsylvania. Goldstein found that the following error processes occurred with the highest percentage: (1) liquid simplification (94 percent), (2) stopping (93 percent), (3) assimilation (87 percent), (4) cluster reduction (83 percent), (5) unstressed syllable deletion (81 percent) and (6) palatal fronting (20 percent).

Stepanoff (1991) analyzed the phonology skills of 20 Puerto Rican Spanish speaking children. Her sample included three and four year olds attending the Escuelita Maternal at the University of Puerto Rico in San Juan. Stepanoff found that the following error processes occurred with the highest percentage: (1) /r/ deviations, (2) strident deviations, (3) postvocalic omission, (4) /l/ deviations, and (5) consonant sequence reductions.

Villanueva (1991) investigated the phonology of five Puerto-Rican Spanish speaking children seen at the Clinica de Trastornos at the University of Puerto Rico in San Juan. They ranged in age from three to ten years. She found the following processes to be occurring frequently: (1) postvocalic omission, (2) strident deviations, (3) /r/ deviations, (4) consonant sequence reduction, (5) /l / deviations, (6) glide deviations, (7) syllable reduction, (8) strident deviations and (9) nasal deviations. The number of process errors noted in this study could possibly be attributed to the small sample size and the varying age range of the sample.

As with the previous normal phonological studies, many of the processes mentioned as frequently occurring may be attributed to dialectal influences (i.e., phonological transference between English and Spanish) not accounted for in these studies. For example, the processes involving stridents, /r/, postvocalic omissions, consonant sequence reductions, liquid simplifications, cluster reduction, unstressed syllable reduction, nasal and velar deviations may be attributed to dialectal influences and not true disorders. Thus, the processes not affected by dialect seem to be assimilation, palatal fronting and glides.

The studies by Meza (1983), Stepanoff (1991), Villanueva (1991) and Goldstein (1995) differed with respect to cluster reduction. Goldstein (1995) mentioned that the difference of cluster reduction could be attributed to a difference in the process definition. Meza (1983), Stepanoff (1991), and Villanueva (1991) defined it as contiguous segments in contiguous consonants and word-initial clusters. Goldstein only considered word-initial consonant pairs.

GROUPS COMPARISON

A retrospective clinical descriptive comparison of disordered Spanish and English phonological development in groups of young Spanish and English speaking children in south Florida follows. Specifically, the descriptive information presented here compares disordered English and disordered Spanish phonology for Cuban dialect. To date no studies of disordered Caribbean Spanish phonology involving Cuban speakers (the predominant Spanish dialect in south Florida) have been published. This study provides information for speech-language pathologists working with Spanish speaking students, specifically with the Cuban dialect of Spanish.

Data were gathered in a clinical setting over a period of six years. All subjects presented with disordered phonology according to parent report, clinical judgment and outcomes from phonological measures (*APP-R*, and *APP-S*).

Children were categorized into two groups. Data were collected and analyzed for children tested in both English and Spanish (n=7). Each child was compared to her/himself. This provided intra-subject or within group information. The second group data set was analyzed for subjects speaking only English versus speaking only Spanish (n=8). A between groups descriptive comparison was conducted to ascertain information to contribute information to this data base. The first group of children served as their own matches/controls, while the latter were cross-group matched. All children were from Spanish speaking or bilingual homes (Spanish/English). All were at least exposed to spoken Spanish. Overall, this data base consisted of 10 males and five females. All ranged in age from 3:1 to 5:9 (n=15); the mean age was 3:8. None had been enrolled previously for treatment and none evidenced hearing problems as indicated by a hearing screening.

Children for the second comparison (across group comparisons) were matched for age as closely as possible and in most cases the median ages were exactly matched or revealing differences of no more than one month.

Children were tested using two phonological measures, the *Assessment of Phonological Process-Revised (APP-R)* (Hodson, 1985) and the *Assessment of Phonological Process-Spanish (APP-S)* (Hodson, 1986). The *APP-S* is widely used in clinical settings with Spanish speaking children in south Florida. All data collection and analyses were done according to the standardized procedures set forth by Hodson (1985; 1986).

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RESULTS OF DATA COLLECTION

Error means (i.e., frequency of occurrence errors) were compared for the first study. Results for the first group indicated differences in the frequency-of-occurrence errors for syllable reduction, prevocalic omission, postvocalic omission and /r/ deviations. The means of most processes involved with the intra-subject comparisons (9/10) for Spanish were greater than means for the processes in English. The means for the within group study (intra-subject) comparisons are provided in Table 1.

Comparisons for the second group (across group study) data of Spanish versus English phonological processes indicated that means for most processes involved (7/10) for Spanish were greater than means for the processes in English. One mean process score was equal in both languages, while one process score was greater in English. An analysis of these data revealed differences in the frequency-of-occurrence for postvocalic omission and nasal deviations. The means are provided in Table 2.

Table 1. Spanish and English Phonological Process Means for Study One (Intra-Subject Comparisons)

Process	Spanish	English
Syllable reduction	12.621	3.714
Consonant sequence reduction	55.081	36.357
Prevocalic singleton omission	11.973	1.5000
Postvocalic omission	33.714	4.747
Strident deviations	47.996	27.936
Velar	16.230	12.621
/l/ deviations	38.004	38.781
/r/ deviations	76.076	13.029
Nasal deviations	15.369	13.029
Glide deviations	20.937	9.286

Table 2. Spanish and English Phonological Process Means for Study Two (Across Group Comparisons)

Process	Spanish	English
Syllable reduction	20.000	16.000
Consonant sequence reduction	23.000	13.000
Prevocalic singleton omission	21.500	14.500
Postvocalic omission	25.000	11.000
Strident deviations	24.000	12.000
Velar	17.500	18.500
/l/ deviations	16.000	20.000
/r/ deviations	18.000	18.000
Nasal deviations	26.000	10.000
Glide deviations	22.000	14.000

DISCUSSION

To date, disordered phonological processes in bilingual children have not been examined extensively (Brice & de la Paz, 1994; Goldstein, 1995; Meza, 1983; Stepanoff, 1991; Villanueva, 1991). It has been known that different languages present similar phonological processes, however, the extent of error process occurrence has not been studied in detail.

Almost all Spanish process means for this data collection were found to be greater than English process means in the first study group (i.e., the within subject group). These differences may be accounted for in several ways. First, since Spanish was the first language for these children, it may be that the phonological process errors are more prevalent in the first language. When children acquire a second language that includes a different phonological system than that of the native language, then error patterns may persist more in the primary language. This may be questionable in light of the second language acquisition research suggesting that second language learners make the same grammatical errors as first language learners. It is also known that the developmental sequence is the same for both first and second language learners (Dulay, Burt, & Krashen, 1982). It does not seem likely that Spanish is significantly more difficult than English phonological acquisition. In fact, it (Spanish) may be phonetically simpler (Navarro, 1968; Stockwell & Bowen, 1965). Second, it has been noted by the authors (both fluent native speakers of Spanish) that Spanish requires continuous and prolonged articulatory contact (more tense articulation at least in the initial positions of syllables), while English allows for lighter articulatory contact (lax articulation). Terrel (1989) stated this point: "In general, Spanish sounds are produced crisply with heightened articulatory tension. In particular, syllable-initial consonants and following vowels, particularly if stressed, are clearly and forcefully pronounced" (p. 205). Thus, while Spanish may not be harder to acquire it is possible that Spanish requires more articulatory effort. Third, the results may be artifacts of the assessment instruments (i.e., of the *APP-R* and *APP-S*). The Spanish version of the *APP* seems not to have changed greatly since its initial development. The ten basic processes from the English version may not account for intelligibility in Spanish. Thus, the ten processes on the Spanish version may not be the same basic phonological processes found in Spanish that contribute to incomprehensibility.

The results for the second group also indicated differences between the frequency of occurrence means (for the across group comparisons) of the processes for syllable reduction, pre-vocalic singleton omission, post-vocalic singleton omission and /r/ deviations.

Syllable reduction/deletion has also been found to be a frequently occurring process (Goldstein, 1995; Meza, 1983). Spanish syllable structure does not emphasize the final consonants (Canfield, 1981; Hammond, 1989). Syllable reduction and

post-vocalic omissions seem to be strongly influenced by Spanish dialect, and thus they are not true errors. Stridency /s/ is deleted or replaced by aspiration in some dialects of Spanish in the syllable-final position, particularly in Caribbean Cuban Spanish dialect (Hammond, 1989). This was confirmed by verbal statements made by the parents of the Spanish speakers in this comparison. Thus, postvocalic omissions may also be affected by this dialectal feature. For example, the word "estampa" could be affected and result in /e_tampa/.

Deviations with both tap /r/ and trill /rr/ were found to be higher with the Spanish sample. It should be noted that *APP*-Spanish does not differentiate between the tap /r/ or trill /rr/ sounds. It also does not differentiate between the Spanish tap /r/ versus the English /r/. The Spanish tap /r/ is a different phone from the English /r/ both in manner and place of articulation (Canfield, 1981). The tap /r/ and trill /rr/ may require increased articulatory proficiency and thus result in error production with greater frequency. Test artifact may also account for these differences. Nasal deviations were also found to be higher with the Spanish intersubject comparisons. This feature may also be affected by dialectal variations as Spanish incorporates a different palatal /ñ/ nasal while English incorporates the /ŋ/. Hammond (1989) notes that the Caribbean dialectal variation of /ŋ/ velarization in word-final positions (i.e., a backing process) may affect phonological scoring.

Phonological interference across Spanish and English may be occurring within some phonological processes. Major (1987) found that beginning second language learners rely more on their L1 (first language) phonology more than advanced bilingual speakers and that the latter group relied less on transfer skills. With increased reliance on transfer of L1 to L2 (second language) phonology the extent of interference errors increases. The children in this sample would invariably be classified as beginning second language learners, thus they would be more apt to transfer their Spanish to English. In conclusion, some group differences (as indicated in this sample) on the *Assessment of Phonological Processes (Revised or Spanish)* may be attributed to variations in dialect, lexicon, or interference issues.

CONCLUSIONS

In summary, there is little data concerning disordered Spanish phonology, especially that of Cuban Spanish speakers. This paper has attempted to shed some light on this issue. A review of pertinent literature and data collected from two groups of children has been presented. Treatment planning and efficacy of treatment continues to be an issue of concern that should be examined by clinicians and researchers as well as the relationship between single versus bilingual language phonological development.

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Open Water Caloric Reference Values

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Instrument-specific normative data are presented for the caloric subtest of the electronystagmography test battery. Clinical caloric reference values for the measurement of unilateral weakness, directional preponderance and the fixation suppression index are presented based upon the caloric data for 80 subjects. These data are specific for ICS Medical equipment.

Electronystagmography (ENG) makes use of electro-oculographic recording of the eyes, via recording electrodes placed upon the skin around the outside of each eye, to identify ocular motor system and vestibular system task aberrations. The ENG test battery commonly consists of an ocular motor series, a positional and positioning series and a caloric series of subtests. ENG, therefore, possesses many subtests to assist clinicians in the differential diagnosis of vestibular system diseases and disorders. ENG is by no means the only way to assess the balance-impaired patient, and there are many studies which compare and contrast different clinical evaluations of the vestibular system (Baloh, et al., 1979; Jacobson, et al., 1990 and Cobb, 1995). ENG is usually considered only a part of the evaluation process of the balance-impaired person. Other parts of this evaluation process may include, but are not limited to, a case history, audiometrics, evoked potentials, rotary chair tests and posturography.

This article focuses upon the alternate binaural bithermal (ABB) caloric test which makes use of a nonphysiologic stimulus (a water irrigation of the external ear canal) to provide information about both the health of each horizontal semicircular canal and the vestibulo-cerebellar system. The ABB caloric test parameters are rigorously controlled and consist of a water irrigation temperature that is different from normal body temperature. The result of such an irrigation delivered to a single ear canal is activation of the vestibulo-ocular reflex (VOR) and horizontally directed nystagmus. There are many possible measurements of this resulting nystagmus. Among these, the maximum slow phase velocity (MSPV) is the most sensitive indicator of vestibular system damage (Baloh, et al., 1977). Using this metric and well-known calculations, individual clinics are encouraged to collect and use their own laboratory norms (Baloh and Honrubia, 1990). Calculations for a significant unilateral weakness are based upon a formula for determining symmetry of vestibular function. Similarly, the formula for determining a significant directional preponderance contrasts symmetry of the resulting nystagmus. Finally, the formula for assessment of failure of fixation suppression contrasts nystagmus MSPV with the eyes open and fixed versus without visual fixation. These formulas are common (Jacobson, Newman & Kartush, 1993). A parametric approach using the traditional +/- 2.5 standard deviations from a normal mean value to correspond to a 98 percent reference range (confidence interval) was used in obtaining measures of unilateral weakness, directional preponderance and failure of fixation suppression (Sills, et al., 1977; Demanez and Ledoux, 1970). As a product of a current research protocol, normative caloric and FFSI data are presented.

METHODOLOGY

Subjects

Eighty informed volunteers, ranging in age from 24 to 85 years who did not suffer dizziness symptoms, were subjected to a full research protocol of historical data, otoscopy, audiometry, tympanometry, 1 kHz acoustic reflex thresholds, 1 kHz acoustic reflex decay test, EOG electrode placement and calibration, horizontal pursuit ocular motor tests, ABB calorics and FFSI data. Historical data excluded subjects with any report or medical record evidence of external and middle ear disease, otosurgery, inadequate vision, facial weakness and/or numbness, asymmetric sensorineural hypacusis, neurogenic hypacusis, tinnitus, imbalance, dizziness, aural fullness, otalgia, head trauma, neck trauma, barotrauma and systemic disease processes. Systemic disease processes included pulmonary, vascular, cardiac, blood, blood pressure, liver, migraine, neurologic, thyroid, substance abuse and ototoxic medication concerns. Otoscopic examination involved visual inspection of the external ear, ear canal and tympanic membrane. Cerumen management was implemented when appropriate. Tympanometry and acoustic reflex tests provided measurements of normal ear canal volume, normal tympanic membrane compliance, a present acoustic reflex threshold and no acoustic reflex decay as evidence of normal middle ear and retrocochlear function. Subjects with abnormal tympanometric and/or absent acoustic reflexes were excluded from the study. Audiometrics were performed to exclude any subject with high frequency (the average of 3 k, 4 k and 8 kHz) asymmetry of 30 dB or greater to rule out the remote possibility of retrocochlear disease.

Procedure

Ocular motor and VOR stimulation data were recorded via the placement of seven recording electrodes upon the surface of lightly abraded skin along the horizontal and

vertical axis of each eye. This electro-oculographic (EOG) recording technique monitors eye movements via the corneoretinal electrical potential of the eyeball and DC coupled biologic amplifiers. Eye movements were calibrated and all data were collected using commercially available equipment (ICS Medical CHARTR) for storage and analysis. Eye movements were provoked voluntarily by the use of a red-colored LED and lightbar (model NOS-30), placed four feet and directly in front of the subject's eyes and involuntarily through the vestibulo-ocular reflex (VOR) after vestibular stimulation. Subject to lightbar distance was monitored by the "range finding" feature of the lightbar. All subjects were seated and then reclined in a JedMed (Phoenix model) hydraulic examination chair with 30 degrees from a supine position pre-programmed into the chair. The subject's head was supported by the chair's adjustable head rest. The lighting within the examination room was semi-dark and a comfortable room temperature was maintained throughout all sessions.

The ABB caloric stimulation was provided by an open water system (model NCI-480) and involved the placement of an irrigation delivery tube into the external ear canal and the delivery of 250 ml of water within 40 seconds to each ear at both 44 degrees and 30 degree centigrade. The body/ear temperature of subjects was not assessed. There were four irrigations in all. No attempt was made to repeat irrigations. Equal distance of the irrigation tube into the external auditory meatus was maintained by use of two .5 cm red marks placed along this tube. Visual fixation suppression was tested using a ceiling-mounted (Model NC-10) light bar and a red-colored LED visual target after the irrigation and after the presumed MSPV peak of the caloric response. A ceiling-mounted lightbar, used to check EOG calibration, was also four feet from the subject's eyes. Frenzel's lenses (Model FL-15) were placed upon the subject's eyes during all caloric tests to eliminate fixation while maintaining the eyes in an open position and thus eliminating the possibility of so called "Bell's phenomenon." These lenses were only removed for a period of 10 to 15 seconds during the caloric test for fixation suppression purposes. EOG calibration was reviewed prior to each caloric irrigation. The subject was then dismissed. The total test time was about an hour and a half.

Data Analysis

A descriptive correlational research design was used. The resulting nystagmus data: the maximum slow phase velocity nystagmus eye movements (in degrees per second) for the caloric-induced vestibulo-ocular reflex were analyzed with and without visual fixation. Analysis is provided below. Calculations for a significant unilateral weakness were based upon the formula for determining symmetry of vestibular function. The formula for determining a significant directional preponderance contrasts symmetry of the resulting nystagmus. The formula for assessment of failure of fixation suppression contrasted nystagmus MSPV with the eyes fixed versus without fixation (Jacobson, Newman and Kartush, 1993).

Results

Nearly 300 applicants were evaluated to produce 80 qualified subjects (Appendix A). There were seven twenty-year-old, eight thirty-year-old, twenty-five forty-year-old, fifteen sixty-year-old, twenty-three seventy-year-old and two eighty-year-old subjects. There were no fifty-year-old subjects which separates the younger and elder groups. Most of the younger group (62 percent) were aged 40 through 49 years old. Most of the elder group (38 percent) were aged 70 through 79 years old. There were thirty female and fifty male subjects. There were no adverse reactions to the research protocol, and no dismissals from the protocol were requested.

All MSPV eye movement data were measured and verified by the system user. No caloric data were accepted solely because it was processed by the automated data analysis routines of the CHARTR software. The range of MSPV varied from three degrees per second to 57 degrees per second. These data sets include MSPV, percent unilateral weakness, percent directional preponderance and FFSI data. Based upon these data sets, and for the specific equipment used, laboratory norms (2.5 standard deviations) for a unilateral weakness were defined as greater than a 22 percent asymmetry between left- and right-sided responses, a directional preponderance as greater than a 22 percent asymmetry between left- and right-beating nystagmus and the FFSI as great than 63 percent is abnormal. These data are similar to previously published reports (Baloh, et al., 1977).

In comparing subjects less than 50 years old to subjects greater than 50 years old, calculations for unilateral weakness (UW) and directional preponderance (DP) were comparable and stable (younger group UW = 23 percent; elder group UW = 20 percent; younger group DP = 23 percent; elder group DP = 20 percent). The calculations used to measure FFSI did differ with younger subjects having an abnormal FFSI at greater than 68 percent and elderly subjects having an abnormal FFSI at greater than 57 percent (Appendix A, "2.5 Standard Deviations from all mean data").

DISCUSSION

It is thought that the collection of instrument- and laboratory-specific normative data will assist in decreasing data variability, making ENG a more sensitive and specific diagnostic tool for that particular clinic setting. This thought has yet to be empirically tested but the reductionistic principal behind it is logical. The use of two and a half standard deviations from a normal mean value will assist the clinician in defining a "likely normal population" from which a pathologic population may be distinguished. It is suggested that individual values, that are clearly separate from the reference values above, be considered either clearly within normal limits or clearly abnormal, and individual values close to the reference values obtained be described as either borderline normal or borderline abnormal. This suggestion is based upon the contention that reference values are constructed by taking a sample of data from normal individuals and determining what unlikely values are in a normal population and not necessarily probable values for a pathologic population.

The normal individuals tested in this database lack only MRI confirmation of absent retrocochlear and so-called "white matter" diseases (Baloh, et al., 1995; Baloh and Vinter, 1995). In spite of rigorous controls placed upon subjects, equipment, test environment and test technique, there is variability within the caloric data sets. Normal caloric responses in MSPV range from single digits to nearly sixty degrees per second. The variance of the caloric data sets is greater than ten thousand fold the variance of the ocular motor data sets. Therefore, the suggestion to use the term "borderline" provides the report of findings with a realistic perspective. Of our normal subjects, for example, subjects #14 and #15 have MSPV

averaging only seven degrees per second while subject #55 had a unilateral weakness calculation of 22 percent.

Variability of caloric results has detracted from the sensitivity and specificity of ENG as a clinical tool. A future direction of this research may be to determine if decreasing the range of caloric variability increases sensitivity and specificity measures for ENG. Caloric responses that are "targeted" may allow for the manipulation of stimulus parameters (e.g., temperature and/or flow) in order to produce a nystagmus MSPV that is maintained within a limited range. It seems reasonable at this point in time to automate caloric testing. That is, through fast manipulation of stimulus temperature and/or water flow to allow a computer to evaluate and maintain the nystagmus MSPV parameter at some targeted value (about 15 degrees). But whether this range limiting strategy will assist the diagnostic power of ENG will also need to be addressed.

Finally, it is interesting that comparisons of younger and elder mean data sets are stable and comparable for the measurements of UW and DP but that there is a ten point difference for measures of FFSI. Additional statistical measures are needed to determine if this difference is significant and if age-specific norms need to be maintained for FFSI. The data suggest that if all subjects are held to the same criterion of values of greater than 68 to 70 percent, then we may be calling our elderly subjects normal when indeed their performance is borderline abnormal or clearly abnormal. Follow-up research in this area is being pursued.

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APPENDIX A

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
1					RQ	RQ	RQ	RQ	RQ	RQ	LQ	LQ	LQ	LQ	LQ	LQ	RC	LC	RW	LW		IN		TO	RC	LC	RW	LW	RC	LC	RW	LW	RC	LC	RW	LW
2	SUBJECT	AGE	HrLOSS	GENDER	0.2	0.3	0.4	0.5	0.61	0.71	0.2	0.3	0.4	0.5	0.61	0.71	MSPV	MSPV	MSPV	MSPV	CW%	THR	DP%	THR	PREF	PREF	PREF	PREF	POST	POST	POST	POST	FBI	FBI	FBI	FBI
3	Group A	1	25	3 M	0 78	0 5	0 71	0 66	0 71	0 66	0 79	0 69	0 76	0 66	0 62	0 62	11	12	8	8	-2 86	R	-2 86	R	3 8	3 4	0 6	3 5	0	0 5	0	0	0	14 706	0	0
4		2	38	0 M	0 85	0 78	0 78	0 74	0 78	0 73	0 82	0 78	0 78	0 74	0 72	0 69	13	13	13	13	0 00	L	0 00	R	5 4	2 5	8 1	12 3	0 1	0	0 7	0 5	1 8519	0	8 642	4 065
5		3	34	23 M	0 71	0 66	0 65	0 63	0 63	0 56	0 77	0 76	0 66	0 58	0 62	0 58	15	15	18	10	13 79	L	-13 8	R	10 3	15 4	11 9	8 7	0	2 6	4 6	0 5	0	16 883	38 655	7 4827
6		4	35	2 M	0 68	0 67	0 9		0 73	0 5	0 83	0 73	0 66		0 6	0 5	14	11	14	13	7 69	L	3 85	L	6 9	9	5 5	3 8	0 7	0	0 2	0 3	10 145	0	3 6364	7 8947
7		5	36	3 F	0 81	0 84	0 82	0 79	0 79	0 62	0 82	0 74	0 8	0 8	0 64	0 65	15	21	12	13	-11 5	R	-8 20	R	2 8	19 5	6 7	1 5	0 3	8 5	0 7	0 7	10 714	33 333	10 448	46 667
8		6	49	74 M	0 7	0 69	0 83		0 53		0 68	0 66	0 67		0 81		16	14	18	19	1 49	L	4 48	L	8 1	13 7	14 8	20 5	2 6	0 8	4 8	2 5	32 099	5 8394	32 432	12 195
9		7	44	10 M		0 65	0 74	0 6	0 58	0 54			0 73	0 66	0 54	0 51	13	13	20	20	0 00	0	0 00	0	15 4	12 8	9 6	6 2	0 1	1 4	1 2	0	0 8494	10 938	12 5	0
10		8	10	8 M	0 81	0 69	0 83	0 9	0 82	0 83	1 07	1 01	0 94	1	0 93	0 84	17	25	25	18	-1 18	R	-17 6	R	10	11 5	8 1	12 8	0 5	2 6	0	0 3	5	22 609	0	2 3438
11		9	48	8 F	0 85		0 88	0 84	0 84	0 5	0 92	0 87	0 81	0 89	0 6	0 48	30	28	32	44	-7 48	R	10 45	L	17 3	21 5	25 2	26	1 2	8 9	7 8	10 3	6 9364	41 395	30 952	39 815
12		10	61	10 M	0 9	0 74	0 84	0 62	0 77	0 72	0 8	0 78	0 78	0 76	0 67	0 65	18	16	12	16	-6 3	R	12 50	L	10 9	1 2	4 9	16	1 5	0 1	0 1	0	13 781	8 3333	2 0408	0
13		11	60	10 F	0 91	0 77	0 78	0 75	0 72	0 64	0 88	0 84	0 76	0 74	0 69	0 59	11	14	5	7	-13 5	R	-2 70	R	9 3	15 3	3 2	4 4	0	1 9	0	0 3	0	12 418	0	6 8182
14		12	45	7 F		0 66	0 63		0 34	0 29		0 84	0 91		0 36		14	13	8	9	0 00	0	4 55	L	5 7	8 1	8 2	3 8	0	0 7	2 6	0	0	8 642	41 935	0
15		13	44	10 F	0 89	0 85	0 83	0 86	0 78	0 81	0 93	0 89	0 83	0 78	0 86	0 72	9	14	12	16	-17 6	R	-1 98	R	7	7 5	10 2	17 3	1 2	0	0 8	0 7	17 143	0	7 8431	4 0462
16		14	48	38 M	0 88	0 82	0 75	0 75	0 91	0 57	0 79	0 78	0 73	0 67	0 7	0 65	8	5	8	10	3 23	L	16 13	R	4	4 2	10	7	0 4	0	0 3	0 3	10	0	3	4 2857
17		15	24	2 M	0 81	0 89	0 88	0 88	0 83	0 8	0 86	0 88	0 9	0 84	0 82	0 72	10	8	3	4	4 00	L	12 00	L	5 1	4 6	9 3	16	0 8	0 7	0 1	0 8	15 686	15 217	1 0753	5
18		16	44	6 F	0 88	0 82	0 9	0 85	0 87	0 84	0 97	0 82	0 82	0 84	0 8	0 68	12	14	10	8	0 00	0	-9 09	R	15 4	10	7 8	15	0 3	4	0 3	0	1 9481	40	3 8462	0
19		17	47	15 M	0 85	0 84	0 78	0 71	0 84	0 58	0 81	0 88	0 78	0 79	0 68	0 79	24	29	26	24	-2 91	R	-6 80	R	17 3	29	34 8	13 2	0 7	4 2	8 1	4 4	4 0462	14 483	23 276	33 333
20		18	49	11 M	0 52	0 84	0 88	0 91	0 64	0 4	0 88	0 79	0 9	0 58	0 24	0 64	15	11	14	11	13 73	L	1 98	L	7	13 2	16	10 2	0 1	2 6	3 2	2 5	1 4286	19 697	20	24 51
21		19	44	6 F	0 8	0 69	0 69	0 7	0 58	0 39	0 74	0 67	0 61	0 62	0 37	0 59	18	18	11	15	-8 45	R	8 45	L	5 6	8 7	10	14 4	0 5	1	0 1	5 3	8 9286	11 494	1	36 808
22		20	24	8 F	0 88	1 03	1 08	1	0 96	0 88	1 07	1 01	1 03	1	0 88	0 77	5	8	6	5	0 00	0	-9 1	R	2 9	5 7	1 9	7 2	0	0	0	0 5	0	0	0	6 9444
23		21	34	4 M	0 87	0 75	0 88	0 88	0 97	0 37	0 9	0 88	0 84	0 96	0 52	0 65	30	23	12	7	16 67	L	2 78	L	16 6	1 7	2 1	5 1	9	0	0 7	0	54 217	0	33 333	0
24		22	37	8 M	0 83	0 97	0 82	0 88	0 83	0 86	0 91	0 88	0 97	0 79	0 83	0 67	14	14	22	19	4 35	L	-4 35	R	11 5	8 7	13 9	8 7	8 5	4 8	1 5	0	58 522	71 842	10 791	0
25		23	43	10 M	0 9	0 86	0 78	0 86	0 78	0 56	0 74	0 72	0 76	0 7	0 8	0 78	26	22	22	26	0 00	0	8 33	L	15 4	12 3	19 2	7 8	9 6	3 2	4 8	2 1	62 338	26 018	25	27 632
26		24	31	10 F	0 82	0 75	0 81	0 77	0 78	0 72	0 8	0 73	0 8	0 74	0 84	0 76	29	24	14	15	4 88	L	7 32	L	13 2	11 9	20 5	12	0 7	1 7	1 2	0 5	5 303	14 286	5 8537	4 1667
27		25	45	25 F	0 88	0 87					0 88	0 9			0 73		20	23	20	18	-1 23	R	-6 17	R	16	15 3	8 5	19 8	0	14 2	4	6 7	0	92 81	47 059	34 184
28		26	41	10 F	0 81	0 74	0 84	0 84	0 79	0 7	0 7	0 8	0 9	0 74	0 8	0 82	21	19	22	19	6 17	L	-1 23	R	27 4	8 7	23 5	14 4	0	0	9	3	0	0	38 298	20 833
29		27	44	9 M	0 83	0 86	0 88	0 83	0 84	0 79	0 87	0 86	0 82	0 89	0 85	0 89	15	20	18	21	-10 8	R	-2 70	L	18 8	20 5	18 6	8 5	2 3	4 4	7 5	5 5	12 234	21 483	45 181	84 615
30		28	44	11 M			0 8	0 75	0 88	0 9			0 82	0 64	0 6	0 4	26	26	38	58	-13 9	R	13 89	L	29	28	26 9	37 3	1 9	10	12 3	21 4	8 5517	38 462	45 725	57 373
31		29	65	10 F	0 96	0 82	0 61	0 8		0 43	1	0 95	1 03	0 88		0 63	19	27	20	29	-17 9	R	1 05	L	15 3	18 6	14 8	19 6	3 8	4 6	4 8	0 5	23 529	27 711	31 081	2 551
32		30	27	6 M	0 83	0 83	0 8	0 78	0 77	0 88	0 87	0 83	0 84	0 8	0 78	0 74	14	15	11	15	-9 09	R	5 45	L	12 8	8 5	5 8	13	0 5	2 3	0 3	8	3 9063	27 059	5 1724	46 154
33		31	45	10 M	0 78	0 79		0 75	0 71	0 8	0 81	0 76		0 66	0 64	0 51	9	10	13	12	0 00	0	-4 55	R	3 8	14 2	14 2	15 4	1 4	8 1	7 5	1 2	38 842	57 042	52 817	7 7922
34		32	47	8 F			0 81	0 69	0 59	0 7				0 93	0 71	0 58	17	16	11	11	1 82	L	1 82	L	11 1	11 5	11 5	7 8	0	2 6	0 5	9	0	22 809	4 3478	115 38
35		33	49	10 M	0 88	0 84	0 88	0 83	0 79	0 73	0 88	0 79	0 8	0 82	0 78	0 65	26	27	50	57	-5 00	R	3 75	L	16 9	12 8	32 8	26 1	8 1	2 3	0 1	0	47 929	17 989	0 3087	0
36		34	24	4 M		1 01	1 04	0 96	0 72	0 98		1 07	0 84	0 89	0 84	0 82	31	30	10	22	-11 8	R	13 98	L	19 2	19 2	7 6	15 3	3	2 1	2 1	3 4	15 625	10 938	27 632	22 222
37		35	41	31 F	1 13	1 08	1 09	0 98	0 97	0 94	1 06	1 05	1 05	0 98	0 88	0 85	26	18	17	21	7 50	L	17 50	L	23	15 3	9 6	23 5	1 2	0 3	0 1	0 3	5 2174	1 9608	1 0417	1 2766
38		36	42	10 F	0 94	0 9	0 9	0 88	0 95	0 78	0 5	0 88	0 88	0 82	0 7	0 74	33	28	21	25	0 93	L	8 41	L	23 5	24 2	14 2	25	11 1	4 8	6 8	4 8	47 234	19 835	47 887	19 2
39		37	38	10 F	0 85	0 82	0 82	0 82	0 88	0 83	0 79	0 88	0 83	0 75	0 54	0 74	11	11	18	14	7 41	L	-7 41	R	6 2	10 5	16 9	11 5	0 5	0 5	1 5	0 7	8 0845	4 7619	8 8757	6 087
40		38	29	2 M	0 98	0 95	0 9	0 89	0 9	0 73	1 03	1 02	0 99	0 73	0 65		18	15	10	9	7 69	L	3 85	L	18 6	13 2	8 7	8 7	1 4	1 5	0 5	2 1	8 4337	11 364	7 4627	31 343
41		39	37	43 M	0 9	0 89	0 88	0 96	0 99	0 46	0 81		0 87	0 88	0 54	0 61	9	12	14	10	2 22	0	-15 6	R	6	11 9	14 2	12 8	1	0 3	0 8	1 4	18 887	2 521	5 6338	10 938
42		40	25	8 F	1 23	1 19		1 08	1 04	0 81	1 2	1		0 81	0 68	0 41	33	26	49	38	12 33	L	-2 74	R	23	20	42 8	35 8	7 6	3 8	20 5	3 2	33 043	18	48 122	8 9385

BEST COPY AVAILABLE

APPENDIX B

	A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
43	Group B	41	70	46	M	0 78	0 71	0 74	0 55	0 48	0 42	0 74	0 89	0 58	0 71	0 4	0 34	13	13	13	13	0 00	0	0 00	0	7 8	12 8	7 6	7 1	1 7	3	0	1	21 795	23 438	0	14 085
44		42	74	42	M	0 78			0 55			0 86			0 71			13	12	19	12	14 29	L	-10 7	R	11 5	8 2	18	13 2	1 2	4 4	3 2	1 5	10 436	53 659	17 778	11 364
45		43	85	42	M		0 47				0 37		0 76			0 41	0 48	19	12	10	13	7 41	L	18 52	L	5 1	7 8	14 2	8 2	1 7	0 3	0 5	3 4	33 333	3 8462	3 5211	54 839
46		44	71	30	F	0 65	0 65	0 76	0 73	0 63	0 46	0 67	0 75	0 69	0 66	0 58	0 58	19	14	19	27	-3 80	R	19 48	L	18 8	8 8	14 6	24 8	9 8	0 7	3 4	2 8	51 064	8 1395	23 288	11 29
47		45	65	54	M		0 47				0 37		0 76			0 41	0 48	12	12	10	13	-8 38	L	8 38	L	8 8	7 8	14 2	8 2	1 2	0 3	0 5	0	18 182	3 8462	3 5211	0
48		46	82	19	M	0 53	0 88		0 49		0 4	0 8	0 82		0 55		0 32	8	11	14	10	2 33	L	-18 3	R	7 5	5 3	15 3	5 1	1 2	0	1	0	18	0	8 3359	0
49		47	82	62	M	0 6	0 73	0 56	0 7	0 54	0 48	1 03		0 83	0 67	0 72	0 55	22	16	25	18	16 05	L	-1 23	R	12 5	12 1	20 1	5 5	0	5 1	2 8	0 5	0	42 149	13 83	9 0809
50		48	61	55	M	0 7	0 83	0 88	0 73	0 81	0 67	0 81	0 84	0 88	0 78	0 86	0 6	9	8	14	11	15 00	L	0 00	0	18 8	13 7	8 7	14 2	0 5	0 5	0 5	2 5	2 6598	3 8496	7 4827	17 606
51		49	71	70	M	0 96	0 83	0 9	0 76	0 81	0 78	0 96	0 88	0 89	0 83	0 85	0 75	12	8	11	12	6 88	L	11 83	L	7 8	5 3	8 5	7 6	1	0 5	0 5	0 7	12 821	9 434	5 8824	9 2105
52		50	69	40	M	0 79	0 79	0 73	0 65	0 51	0 44	0 91	0 86	0 81	0 7	0 59	0 43	15	15	30	25	5 88	L	-5 88	R	13	18 4	23	20 5	3 4	7	12 3	7 8	26 154	42 683	53 478	37 073
53		51	65	15	F	0 83	0 76	0 69	0 59	0 48		0 8	0 87	0 82	0 85	0 4		16	20	15	26	-19 5	R	9 09	L	9	15 3	10 2	34 6	4	4 6	0 5	8 9	44 444	30 065	4 902	25 723
54		52	77	92	F	0 53	0 6	0 57	0 56	0 56	0 47	0 75	0 58	0 44	0 68	0 63	0 41	26	25	26	26	-0 95	R	2 86	L	29	21 5	27 4	34 6	2 6	4	2 3	4 6	8 9655	18 905	8 3942	13 295
55		53	61	36	M	0 6		0 39	0 52			0 57		0 51	0 56			10	10	13	8	12 20	R	-12 2	R	8 7	10 7	7 8	4 8	0	0 5	0	1 7	0	4 6729	0	35 417
56		54	70	26	M	0 91	0 86	0 8	0 8	0 73	0 63	0 81	0 8	0 78	0 74	0 72	0 63	15	12	15	13	9 09	L	1 82	R	5 4	8 7	7	10 3	0 1	1	1	1	1 8519	11 494	14 286	9 7087
57		55	75	14	F	0 77	0 9	0 86	0 73	0 66	0 72	0 8	0 81	1 01	0 87	0 78	0 73	28	25	23	54	-21 5	R	26 15	L	23 9	18 8	17 3	38 4	7	0	4 4	8	29 289	0	25 434	15 625
58		56	78	55	F	0 83	0 6	0 68	0 88	0 82	0 64	0 88	0 86	0 59	0 7	0 84	0 57	14	14	18	17	1 59	L	-1 59	R	16 3	5 3	12	11 2	0 7	0 8	0 3	0	4 2945	15 094	2 5	0
59		57	77	43	M	0 82	0 79	0 7	0 9	0 66	0 45	0 81	0 8	0 68	0 74		0 37	13	12	15	15	1 82	L	1 82	L	12 6	11 5	12 9	10 7	0 3	0 7	0	0	2 381	8 087	0	0
60		58	72	64	F	0 9			0 6	0 7	0 45	0 93			0 57	0 4	0 46	36	30	48	41	8 39	L	-0 65	L	35 8	24 7	40 1	36 4	11 1	6 4	10 3	7 6	31 008	25 911	25 686	19 792
61		59	76	52	M			0 7	0 8		0 64			0 75	0 78		0 58	21	24	22	25	-6 52	R	0 00	R	19 4	16	10	26 1	2 6	4 6	2 1	3	13 402	28 75	21	11 494
62		60	60	80	F			0 7			0 52			0 65	0 78		0 26	11	13	13	14	-5 88	R	-1 96	R	9 3	12 8	9 6	23 5	2 5	2 6	0 1	7 6	29 882	20 313	1 0417	32 34
63		61	77	10	F	0 8	0 79	0 74	0 71	0 68	0 64	0 78	0 68	0 69	0 68	0 56	0 41	15	21	20	13	1 45	L	-18 8	R	11 9	11 5	17 3	11 1	1 4	7	1 2	2 1	11 765	60 87	6 9364	18 919
64		62	61	44	F	0 57	0 48		0 92			0 85	0 88		0 73	0 58		20	29	45	41	-3 70	R	-9 63	R	15 3	26 1	39 5	29 9	6 2	10	12 8	11 1	40 523	38 314	32 406	41 264
65		63	83	40	M	0 83	0 82	0 81	0 81	0 69	0 59	0 81	0 9	0 75	0 75	0 67	0 5	18	24	21	23	9 30	R	-4 65	R	17 3	23	13 8	20 5	4	4 4	3 2	6 2	23 121	19 13	23 188	30 244
66		64	78	75	F	0 67	0 64	0 72	0 78	0 66	0 51	0 84	0 7	0 66	0 54		0 44	15	14	15	22	-9 09	R	12 12	L	12 6	15 4	14 2	24	0 5	7 5	2 1	6 2	3 9063	48 701	7a 789	25 833
67		65	72	79	M	1 04	0 72	0 7	0 74	0 69	0 61	0 52	0 79	0 63	0 55	0 58	0 38	14	8	14	11	19 15	L	8 36	L	9 3	9 6	14 2	10 7	0 5	0 7	3 8	3 2	5 3783	7 2917	26 781	29 907
68		66	77	71	M	0 75	0 82	0 83	0 88	0 78	0 8	0 72	0 86	0 74	0 68	0 75	0 68	7	12	11	8	-5 26	R	-21 1	R	7 3	11 5	8 7	7 2	0 1	0	0 1	0 5	1 3899	0	1 1494	6 8444
69		67	72	46	F	0 68	0 54	0 56	0 61	0 59	0 48	0 7	0 79	0 68	0 52	0 6	0 45	17	20	25	30	-8 70	R	2 17	L	19 6	21 4	27 4	27 4	5 1	7 5	12 3	5 1	30 723	35 047	44 891	18 813
70		68	73	68	M	0 78	0 68	0 55		0 45	0 34	0 78	0 68	0 7	0 53	0 48	0 25	20	32	18	20	-15 6	R	-11 1	R	18 5	20 5	11 5	18 8	0 1	3 2	3 8	0 3	0 6061	15 81	33 043	1 5957
71		69	80	82	M	0 83	0 85	0 79	0 71	0 68	0 68	0 86	0 64	0 83	0 72		0 42	13	17	10	9	-6 12	R	-10 2	R	14 2	14 8	7 2	9 3	0 3	0 5	0 1	0 7	2 1127	3 3784	1 3889	7 5269
72		70	68	18	F	0 64	0 9	0 75	0 72	0 68	0 44	0 86	0 87	0 82	0 78	0 74	0 61	29	15	17	22	10 84	L	22 89	L	30 7	13 4	23	16	13 4	6 5	4 6	1 5	43 648	48 507	20	9 375
73		71	82	20	M	0 93	0 8	0 8	0 82	0 74	0 67	0 68	0 84	0 75	0 83	0 84	0 45	10	12	7	10	-12 8	R	2 56	L	12 8	13 7	7	7 5	4	0 8	1 7	0	31 25	5 8394	24 286	0
74		72	60	18	M	0 95	0 89	0 86	0 88	0 81	0 75	0 91	0 87	0 81	0 8	0 77	0 74	9	9	14	9	12 20	R	-12 2	L	9 3	9 7	6 7	18	0 5	5 3	1	0 2	5 3783	54 639	14 925	34 444
75		73	79	70	M	0 88	0 86	0 84	0 37	0 4		0 86	0 95	0 86	0 77	0 56		20	24	17	26	-14 9	R	5 75	L	19 4	22 2	14 2	26	7 6	12 5	6 5	12 5	39 175	56 306	45 775	48 077
76		74	69	78	M	0 52	0 77	0 78	0 58	0 62		0 83	0 72	0 67	0 72	0 66		13	13	20	25	-7 04	R	7 04	L	16	10 3	20 5	21 1	2 5	2 5	4 2	0 1	15 625	24 272	20 486	0 4739
77		75	75	56	M	0 91	0 84	0 7	0 86	0 71	0 54	0 77	0 8	0 8	0 58	0 56	0 58	18	20	16	19	-6 85	R	1 37	L	10	20	7	14 2	0 5	0 7	0 5	0 5	5	3 5	7 1429	45 775
78		76	78	66	M	0 58	0 36			0 17		0 74	0 77			0 17		29	31	22	40	-16 4	R	13 11	L	29 8	26 9	17 3	34 6	9	7 5	0 7	15 3	30 201	27 881	4 0482	44 22
79		77	77	58	M	0 78	0 72	0 68	0 48	0 14	0 18	0 8	0 78	0 88	0 56	0 38	0 38	10	16	14	14	-11 1	R	-11 1	R	9 8	11 1	12 5	16 6	0 7	0 3	0 3	0 5	7 1429	2 7027	2 4	3 012
80		78	69	78	M	0 78	0 79	0 78	0 82		0 48	0 76	0 8	0 78	0 66		0 44	15	16	12	14	-5 26	R	1 75	L	14 6	12 3	13 4	12 5	0	4 4	2 6	0	0	35 772	19 403	0
81		79	79	88	M	0 71	0 75		0 57	0 54	0 5	0 6	0 59			0 34	0 6	16	15	18	21	-2 88	R	5 71	L	11 5	12 6	15 4	19 2	0 3	6	2 6	4	2 6087	48 875	18 182	20 833
82		80	71	63	M	0 75	0 7	0 78	0 69	0 63	0 54	0 71	0 69	0 75	0 72	0 59	0 48	12	13	10	9	0 00	0	4 55	L	9 2	3 8	3 6	7	0 3	0 7	0 3	0 1	3 2609	18 421	8 3333	1 4286
83	Grand Min		24	0		0 52	0 36	0 39	0 37	0 14	0 18	0 5	0 58	0 44	0 52	0 17	0 25	5	5	3	4	-21 5		-21 1		2 8	1 2	0 6	1 5	0	0	0	0	0	0	0	0
84	Grand Max		85	92		1 23	1 19	1 09	1 06	1 04	0 81	1 2	1 07	1 05	1	0 93	0 86	38	32	50	57	19 1		26 2		35 8	29	42 6	38 4	13 4	14 2	20 5	21 4	82 338	92 81	53 478	115 38

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APPENDIX C

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
85	Grand Count	80	80	80	71	73	70	71	70	72	71	71	69	72	70	69	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
86	Grand Average A	39 5	12 8		0 85	0 84	0 83	0 78	0 73	0 64	0 88	0 85	0 83	0 77	0 69	0 65	17 88	17 60	17 08	18 18	0 01		0 02		12 39	12 40	13 17	13 50	2 01	2 75	3 05	2 54	14 60	19 06	18 32	18 57
87	Grand Average B	71 0	51 8		0 76	0 72	0 73	0 69	0 62	0 53	0 80	0 78	0 72	0 68	0 57	0 49	16 30	16 63	17 98	19 53	0 03		0 02		14 28	13 83	14 77	17 34	2 74	3 38	2 78	3 58	18 44	22 62	15 20	17 91
88	S D Group A	8 2	13 8		0 13	0 14	0 12	0 12	0 14	0 15	0 14	0 11	0 11	0 11	0 15	0 11	7 58	8 80	10 29	12 21	9 22		9 22		6 97	6 83	9 82	8 43	3 01	3 15	4 25	4 01	17 69	19 92	17 73	24 75
89	S D Group B	6 9	22 8		0 13	0 14	0 11	0 13	0 17	0 14	0 11	0 09	0 12	0 09	0 15	0 13	6 40	6 72	8 35	10 55	8 00		8 00		7 27	5 99	8 12	9 88	3 39	3 18	3 49	3 84	14 97	18 62	13 53	15 65
90	VARIANCE A	68 1	183 9		0 02	0 02	0 02	0 01	0 02	0 02	0 02	0 01	0 01	0 01	0 02	0 01	57 65	48 25	105 97	149 02	89 72		89 72		48 56	43 91	84 92	71 00	9 05	9 92	18 03	16 09	312 89	396 72	314 41	612 73
91	VARIANCE B	47 3	518 1		0 02	0 02	0 01	0 02	0 03	0 02	0 01	0 01	0 01	0 01	0 02	0 02	40 93	45 11	69 72	111 28	66 78		66 76		52 86	35 91	65 92	97 58	11 52	10 14	12 20	14 76	224 08	348 83	182 95	245 02
92					RC:	LC:	RW:	LW:	Mean	Mean S D																												
93			FSI 20-49		14 6	19 1	18 3	18 6	17 8	20																										
94					RC:	LC:	RW:	LW:	Mean	Mean S D																												
95			FSI 60-90		18 4	22 6	15 2	17 9	18	15 7																										
96	SSD RC A			12202 5																																
97	SSD RC B			8738 29																																
98	SSD LC A			15472 1																																
99	SSD LC B			13526 3																																
100	SSD RW A			12262																																
101	SSD RW B			7135 14																																
102	SSD LW A			23898 5																																
103	SSD LW B			9555 68																																
104					RG 20	RG 30	RG 40	RG 50	RG 61	RG 71																												
105	% for Tracking Freq Ages 20-49				0 85	0 84	0 83	0 78	0 73	0 64																												
106					LG 20	LG 30	LG 40	LG 50	LG 61	LG 71																												
107	% for Tracking Freq Ages 20-49				0 88	0 85	0 83	0 77	0 69	0 65																												
108					RG 20	RG 30	RG 40	RG 50	RG 61	RG 71																												
109	% for Tracking Freq Ages 60-90				0 76	0 72	0 73	0 69	0 62	0 53																												
110					LG 20	LG 30	LG 40	LG 50	LG 61	LG 71																												
111	% for Tracking Freq Ages 60-90				0 8	0 78	0 72	0 68	0 57	0 49																												
112																																				
113																																				
114																																				
115	Clarifying Notes																																			
116	-																																			
117	A is the control group: ages 20 to 49																																			
118	B is the experimental group: ages 60 to 90																																			
119	SSD is the sum square deviation, computed by Excel, used in ANOVA																																			

	RC	LC	RW	LW
	RC SSPV	LC SSPV	RW SSPV	LW SSPV
SSPTV for Ages 20-49	17.88	17.6	17.98	18.18
SSPTV for Ages 60-90	18.3	18.63	17.98	19.53

	RC POST	LC POST	RW POST	LW POST
PREFIXATION AVERAGES Ages 20-49	12 4	12 4	13 17	13 5
PREFIXATION AVERAGES Ages 60-90	14 3	13 83	14 77	17 34
POSTFIXATION AVERAGES Ages 20-49	2 01	2 745	3 048	2 543
POSTFIXATION AVERAGES Ages 60-90	2 74	3 375	2 758	3 583

AGE 20-3	7
AGE 30-3	5
AGE 40-4	35
AGE 60-6	15
AGE 70-7	23
AGE 80-8	3

2.5 Standard Deviations from all mean data

A UW:	23.1	A DP:	23.1	A FSI	87.7
B UW:	20.0	B DP:	20.0	B FSI	57.3
T UW:	21.8	T DP:	21.8	T FSI	82.5

UW is Unilateral Weakness	((RC+RW)-(LC+LW))/(RC+RW+LC+LW) *100
DP is directional preponderance	((RC+LW)-(LC+RW))/(RC+RW+LC+LW) *100
FSI is Fixation Suppression Index	SPV with fixation / SPV without fixation * 100
A = younger group; B = older group	Demarez & Ledoux, 1970

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Specificity in a Universal Hearing Screening Protocol: A Poster Publication

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Progress is summarized on a project investigating the effectiveness and efficiency of a universal neonatal hearing screening program using a protocol combining automated Auditory Brainstem Response (ABR) and otoacoustic emissions (OAE). The specificity of the ALGO 2 ABR is assessed in 300 newborns and compared to the OAE screening in 58 newborns. The two infants failing the automated ABR test underwent diagnostic ABR testing at two months of age. Operating characteristics of the screening procedures were determined.

Early identification of hearing loss is important for the development of speech and language. Infants who are identified with hearing loss prior to the age of two years have been found to have a distinct advantage over their later identified peers (Apuzzo & Yoshinaga-Itano, 1995). Hearing impairment in infants and toddlers can easily go undetected because its effects on early speech and language development cannot be distinguished from variability seen in normal hearing infants (Koop, 1989; Downs, 1994; Northern & Hayes, 1994). The prevalence of hearing loss is estimated to range from 1.5 to 6.0 per 1000 live births (Watkin, Baldwin & McEnery, 1991; Parving, 1993; White & Behrens, 1993).

Three tests are available for screening neonatal hearing — standard ABR, OAE and automated ABR. The Auditory Brainstem Response (ABR) is currently the most widely used procedure in neonatal hearing screening (Mauk & Behrens, 1993). It has long been known to be one of the most reliable ways to measure hearing loss in neonates (Schulman-Galambos & Galambos, 1979; Stein, Ozdamar, Kraus & Paton, 1983; Hall, 1992) and is completely non-invasive and painless. Unfortunately, this procedure is costly to the patient (approximately $350 per test), can take up to 40 minutes per test and requires the expertise and training of a certified audiologist for both the administration and interpretation of the test (Fritsch & Sommer, 1991).

One recently suggested procedure includes otoacoustic emission (OAE) screening with follow-up ABR testing for all failures (NIH, 1993). OAE testing requires extensive training and should be performed by a licensed audiologist. The cost of OAE screening is $75 per infant. A problem with the OAE protocol is that the high false positive rate on the OAE screening leads to unnecessary follow-up testing and undue worry to the family (Bess & Paradise, 1994). Research data on OAE testing in the infant population range from 81 to 100 percent for sensitivity and 29 to 82 percent for specificity (White, Vohr & Behrens, 1993). These numbers entail the assumption that all babies that passed the initial screening procedures did, in fact, have normal hearing. This assumption biases the results in favor of the screening procedure, therefore altering the cost-benefit ratio.

Despite the reliability of ABR procedures, its cost and time requirements have precluded its use in the well baby population for screening procedures. Technological advances have produced new equipment — ALGO 2 which provides automated ABR screening. Testing is performed at bedside in the nursery; the equipment is battery operated and most infants sleep through the procedure. The procedure can be performed by technicians with minimal training. The equipment generates a PASS/REFER result that does not require interpretation. Using the ALGO 2 automated ABR unit, hearing screening can be performed quickly and efficiently at a cost of $60 per infant. A direct cost savings to the patient of approximately 80 percent per test can be realized over standard ABR procedures. A prototype, ALGO 1, has sensitivity and specificity in excess of 95 percent in detecting hearing loss in infants (Jacobson, Jacobson & Spahr, 1990). If the ALGO 2 has similar operating characteristics to the ALGO 1, the reduced cost of the actual screening test plus the reduction in the number of follow-up tests performed on false negative results from OAE testing makes the ALGO 2 screening protocol particularly attractive. This project was designed to investigate the effectiveness and efficiency of a universal neonatal hearing screening program at a large regional hospital using automated ABR and OAE protocols.

METHODS

Three hundred live births underwent hearing screening using the ALGO 2 automated ABR at bedside. All babies were in the well baby nursery and none had any reported risk factors associated with hearing loss.

For the ALGO 2 testing, clicks are presented at 35 dB nHL (soft levels) to each ear individually through earphones. Responses from the baby's brain picked up by the electrodes were amplified, filtered and averaged into a statistical assessment yielding a pass or refer result.

For OAE recording, a rubber-tipped probe was placed in the opening of the external ear canal. This probe produced both the click stimuli and recorded the response. The best of three responses was selected for analysis for each ear. Results were stored on a computer diskette for pass/fail judgements. A pass was defined as an emission amplitude at least 3 dB above the noise floor in at least two of the three one-thousand Hz bands between 1000 and 4000 Hz. Figures

1 and 2 show examples of OAE results from one ear meeting and one ear not meeting this criterion. This protocol was completed for 58 of the babies undergoing the ALGO 2 screening. Infants who received the refer result on the initial ALGO 2 screening were called back for diagnostic testing at two to four months of age.

RESULTS

To date 300 infants have been screened using the ALGO 2 protocol. Of these babies, 298 passed in both ears, one failed in one ear and one failed in both ears. Follow-up diagnostic ABR testing of the two infants that failed the screening protocol revealed both had normal hearing at four months of age. These results yield a specificity rate of 99.33 percent for the ALGO 2 protocol.

Using the same two clinicians, over 50 babies were screened with OAE using various test techniques to establish the optimal test protocol for probe placement, etc. None of these data are included in the results and should be considered as training data. Once the protocol was established eliminating as much noise floor and probe placement problems as possible, actual data collection commenced.

Fifty-eight babies were also tested using the OAE protocol in addition to the ALGO 2 protocol. Using a pass/fail criteria of at least 3 dB in at least two frequency bands between 1000 and 4000 Hz, 50 babies failed. All the babies that passed OAE also passed ALGO 2. On the other hand, all 50 that failed OAE passed ALGO 2, yielding a specificity of 13.79 percent compared to the ALGO 2.

DISCUSSION

Results of the present investigation support the previous findings with regard to the effectiveness of the ALGO automated ABR procedure in neonatal hearing screening (Jacobson et al., 1990). The specificity of 99.33 percent obtained in the current study would suggest that the ALGO 2 would yield a low over-referral rate. This addresses the primary concern for the implementation of universal hearing screening raised by Bess & Paradise (1994).

If the sensitivity of the ALGO 1 reported by Jacobsen et al. (1990) can be generalized to the ALGO 2, the automated ABR screening protocol used in this study would be an optimal choice for universal screening. Further research on this question is

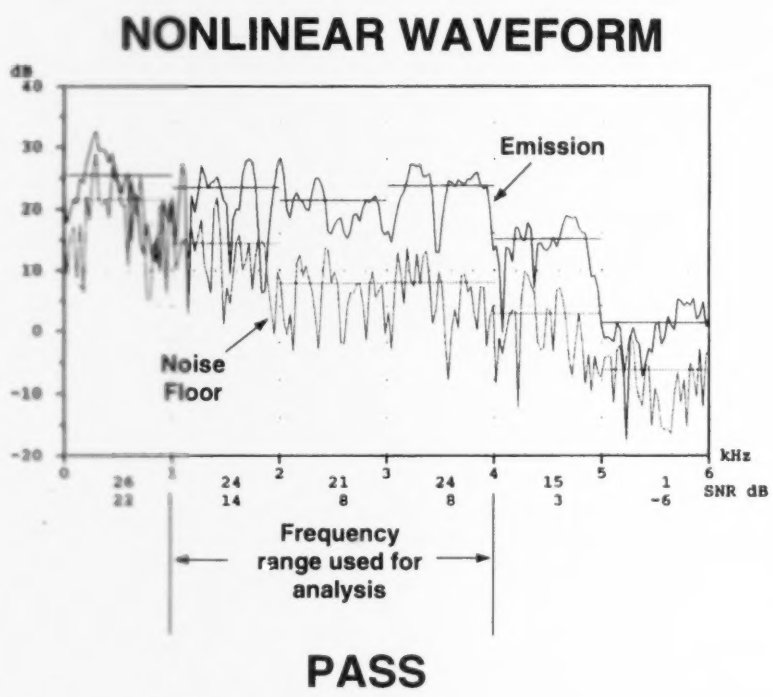

Fig. 1 Example of MLS OAE result meeting PASS criterion.

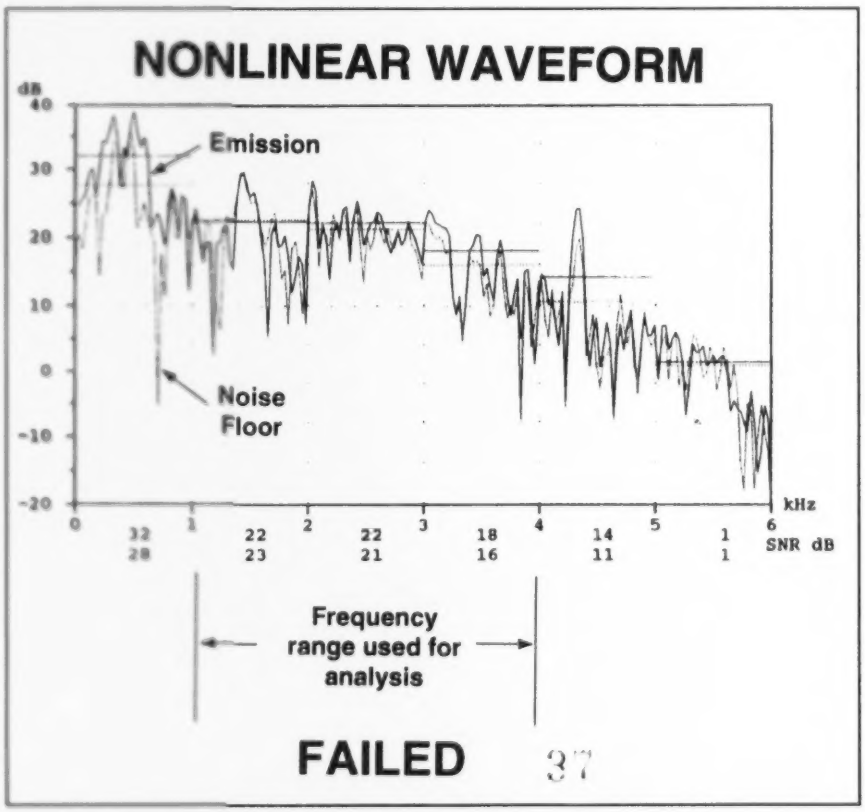

Fig. 2 Example of MLS OAE result failing to meet PASS criterion.

needed.

On the other hand, the specificity of less than 14 percent obtained in the current study for the maximum length sequence transient otoacoustic emission (MLS-OAE) protocol would produce an unacceptably high over-referral rate. Other studies of OAE procedures have suggested that these over-referral rates were due to clinician error observed during an extended learning curve for this technique. In the current study, over 50 infants were tested by the two audiologists (BEK and ETM) who collected the data prior to the initiation of the actual research protocol. This training period was used to control for any learning curve effects. Even with this extensive training period and the use of clinical audiologists, the specificity rate of the OAE protocol was alarming. From the results of this investigation, an MLS-OAE procedure is not acceptable for universal neonatal hearing screening. Further research is needed to demonstrate the operating characteristics of other otoacoustic emission protocols.

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"The salesman told me this was the right microphone?!" A Tutorial in Reading and Interpreting Microphone Specifications for Accurate Voice Recording: A Poster Publication

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You are a scientist and your microphone (mic) is your data recording device. Recording accurate data is imperative. When purchasing a mic, your objective should be to acquire a mic that is *accurate*. In other words: *a microphone that will capture a true representation of your source.* When talking to a salesperson, stress that you need a mic that is *precise*, not one that "sounds good." There are seven specifications of which you need to be aware:

(1) Frequency Response, (2) Directional Sensitivity, (3) Sensitivity, (4) Signal-to-Noise Ratio, (5) Inherent Noise, (6) Maximum Input Level and (7) Impedance.

These indicators lend valuable insight into a mic's performance characteristics. In order to compare mics, you need to know the meaning of each specification and the impact that specification may have on your recordings. Frequency is referenced as Hz (Hertz) or cycles per second and intensity as dB (decibels) relative to sound pressure level (SPL).

FREQUENCY RESPONSE

This is how a mic "hears" different frequencies. It is expressed as a plot of amplitude and Hz or as a statement such as: *"Frequency response = 125 Hz to 16 kHz (+/- 3 dB)."* The reference to "+/- 3 dB" is an indication of how much the mic might vary from one frequency to another. The equation above might look like the graph below (Fig. 1).

If the mic does not record equally across frequencies, it will color your data with "its" sound. Of all of the specifications, frequency response will most directly impact the quality of a recording.

• *A mic for scientific testing should have a minimum range of 30 Hz to 18 kHz (+/- 1 dB).*

DIRECTIONAL SENSITIVITY (AKA POLAR PATTERN)

Mics are generally categorized as one of three types: (1) *OMNI-directional*, equally sensitive to sounds from all directions; (2) *Cardiod (uni-directional)*, more sensitive to sounds from one direction only, less sensitive to sounds from behind and (3) *Bi-directional*, equally sensitive to sounds from the front and rear, less sensitive to sounds from the sides (Fig. 2). The "Directional Pattern" or "Polar Pattern" is how a mic hears sounds coming from different directions. It is usually expressed as a circular graph with a dB reference on an x-y axis and a directional source reference (0°-359°) on a circular axis (Fig. 3).

• A mic may not have one well-defined pattern. At lower frequencies, it may have one type of pattern; in higher frequencies, it may have another.

SENSITIVITY

This is the over-all electrical output of the mic when it is exposed to sound. The mic is placed in a quiet room, a tone is played from a speaker and the electrical voltage coming out of the mic is measured. Some manufacturers list the mic's output as millivolt (*x* mV); other manufacturers list it as negative dB (-*x* dB). *Interpreting sensitivity references are simple.*

• This is a relative reference level.

If two mics were placed in the room with the speaker playing a 94 dB tone and one had an output of 10 mV and the other 5 mV, the one with the greater output is more sensitive, i.e., the 10 mV mic has two times the output for the same 94 dB input. *The more sensitive the mic, the less amplifica-*

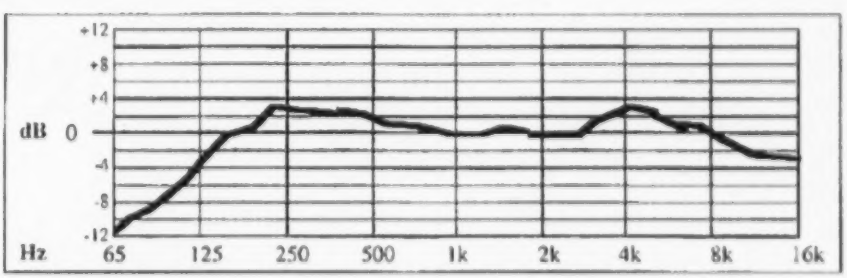

Fig.1. A typical frequency response graph of a mic with a usable bandwidth between 125 Hz and 16 kHz. This mic has a 3 dB boost at 250 Hz and 4 kHz. Note: WIDER BANDWIDTH + SMALLER VARIANCE = MORE ACCURATE MICROPHONE.

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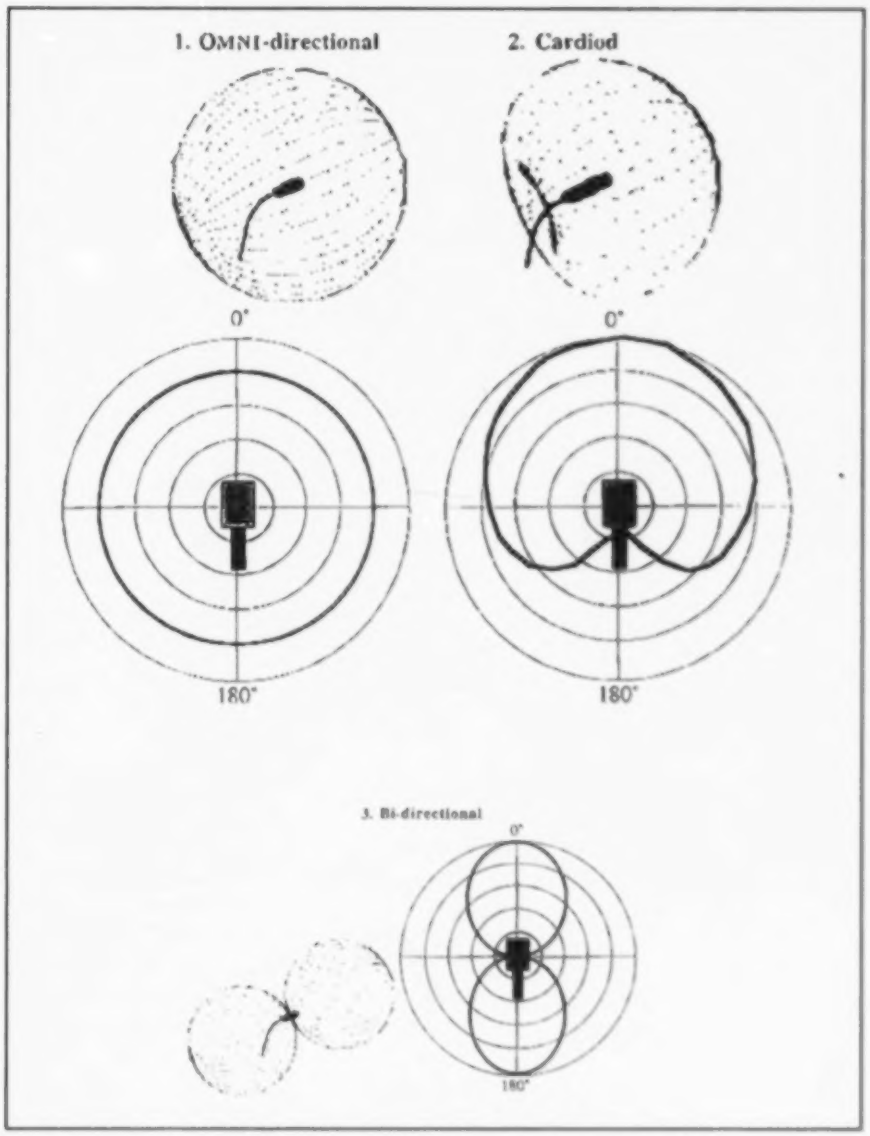

Fig. 2. Three basic directional patterns with each respective polar graph.

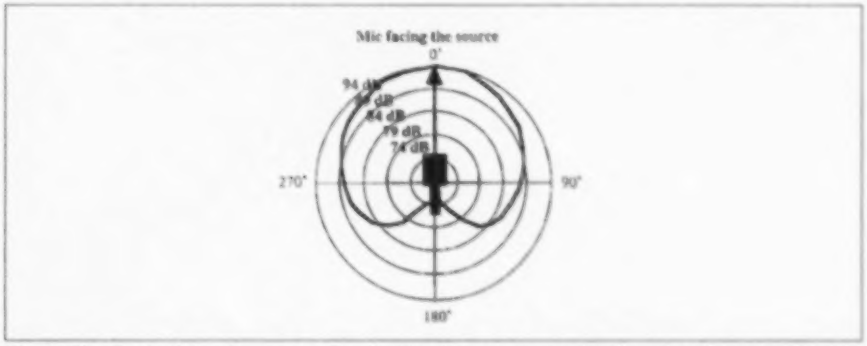

Fig 3. The Basic Polar Response Graph. Used to represent the directional sensitivity of a mic. The outermost circle usually depicts 94 dB SPL. Each inner circle represents a -5 dB reduction in signal. The innermost circle then represents a drop of 20 dB SPL from 94 dB SPL (i.e., 74 dB SPL). 0° is considered to be "on-axis" where the mic is directly facing the source. The angular reference (0-360°) is the position of the source in relation to the direction in which the mic is facing.

tion you will need to get the signal up to a usable operating level.

Another way to show the electrical output of a mic is by using a negative dB rating. "0 dB" is used to represent the 94 dB tone that is played from the speaker. A mic with a -55 dB rating is 5 dB *more sensitive* than a -60 dB mic, i.e., its output is closer to 94 dB (the 0 dB reference).

INHERENT NOISE

This is a rating for random noise contained in a mic's output signal. *Every mic* has some amount of noise in its output. If you could place the mic in a perfectly quiet room, this would be the noise coming out even where there is no input signal. It is normally listed as: *"Equivalent loudness level due to inherent noise"* or *"Equivalent noise level."*

Noise is rated in dB SPL. In general, the listing will read something like:

Equivalent noise: 27 dB-A
38 dB

Most manufacturers list two ratings, dB and dB-A.

• *When you are comparing two mics, be sure to compare like ratings (i.e., dB-A to dB-A).*

SIGNAL-TO-NOISE (S/N) RATIO

This is the difference between the 94 dB SPL input reference played from the speaker and the mic's inherent noise. It is normally rated in dB-A. For the mic listed above, subtract 27 dB-A from 94 dB. The S/N ratio of that mic would then be 67 dB-A. *If you know the S/N ratio, you can calculate inherent noise and visa versa. Sensitivity, Inherent Noise and S/N Ratio are interrelated. If the mic has low sensitivity, its output will be closer to its inherent noise; therefore, its S/N ratio will be smaller, and more random noise will be added to your signal.*

• For scientific use, you need the highest S/N ratio, the lowest possible inherent noise and the greatest sensitivity possible.

MAXIMUM INPUT LEVEL

This is a dB SPL rating of how much signal the mic will accept before "unacceptable" distortion occurs. It is usually listed as "total harmonic distortion" (THD)[1]. Most professional mics will handle 130 to 145 dB SPL before noticeable distortion occurs. For voice recording, maximum input level is usually not a problem because normal speech does not reach excessive levels. But remember, for your purposes that is, in the collection of accurate data *any harmonic distortion is unacceptable, noticeable or not. in general, the higher the dB SPL and the lower the THD, the better.*

IMPEDANCE

Impedance in voice production is the opposition to sound transmission through the vocal tract (i.e., constriction). Impedance for a mic is the opposition to the flow of electricity through the circuit connected to the mic. Electrical impedance is rated in *ohms* (abbreviated as "Z"). Mics are generally rated in two categories of impedance: *Low-Z (150 to 300 ohms) and High-Z (10 k to 50 k ohms).*

A full discussion of impedance is beyond the scope of this poster; however, there are a few mic characteristics that are directly related to rated impedance.

Low-Z Microphones. Cables can be run up to 1,000 feet with no significant signal loss. As impedance decreases, inherent noise decreases. Use balanced electrical connections which provide protection from electrical interference such as CB radios, cellular phones, computers, etc.

High-Z Microphones. Noticeable signal degeneration occurs with about 15-20 feet of cable. As impedance increases, inherent noise increases. Use unbalanced electrical connections which are highly susceptible to electro-magnetic interference from florescent lights, CB radios, cellular phones, computers, etc.

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[1] **THD is the numerical sum of all harmonic distortion components in the signal.**

Effectiveness of an Adhesive Wax Guard for ITE Hearing Aids: A Poster Publication

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Hearing aid failure due to cerumen-induced problems accounts for 80 percent of all factory repairs (Siemens Hearing Instruments, 1991) at an estimated annual cost of $25 million (Oliveria, 1993). In an effort to control and reduce this occurrence, manufacturers have developed various types of wax guard systems. These attempts, however, have met with mixed results, primarily due to the difficulty in removing, cleaning and/or inserting the various "wax traps" on the market. A recently developed system, the Ad Hear™ Wax Guard claims to offer a solution to preventing cerumen-induced hearing aid failure while providing the patient with a relatively easy method of replacing the device. The goal of this study was to determine if an adhesive wax guard effectively prevented cerumen-induced hearing aid failure and offered good user-friendliness.

METHOD

Subjects

Fifty-three adult veterans receiving hearing aid services through the audiology department of Bay Pines VA Medical Center served as subjects for this study. No subjects were excluded on the basis of age, gender or degree/type of hearing impairment.

Materials

Newly fit ITE instruments, adhesive wax guards and otoscope.

Instrumentation

Participant and dispenser surveys were designed to determine relevant patient characteristics (e.g., manual dexterity, visual acuity, amount of skin debris produced and ear side difference in terms of cerumen produced); amount and degree of debris in sound and ventbores at follow-up; and satisfaction with the adhesive and non-adhesive wax guards which, for this study, included only extended receiver tubing.

Procedure

(A) Initial visit: dispensed binaural hearing aids; tossed coin to determine which aid used the adhesive and non-adhesive wax guard; instructed patient on use.

(B) Four week follow-up: inspected aids for amount and degree of debris penetration in soundbores and vents; administered satisfaction surveys.

RESULTS AND DISCUSSION

Table 1 illustrates the subjects' and experimenter's (in parenthesis) judgment concerning manual dexterity and visual acuity. In terms of manual dexterity, this factor appeared to have little influence on results as only four participants reported fair or poor dexterity. Similarly, since the majority of participants also reported excellent or good visual acuity, this factor was also believed to have little influence on results. In terms of both manual dexterity and visual acuity, while most subjects and the experimenter reported functioning to be average or better, there appeared to be some differences between subject report and experimenter observation. These differences were most likely due to the limited time the experimenter spent with participants.

Table 2 shows the subjects' and experimenter's (in parenthesis) report on the amount of skin debris produced. There is considerable disagreement between the judgments of the subjects and the experimenter with the subjects overestimating (or the experimenter underestimating) the amount of debris. There is one possible explanation: participants were reporting their perceptions without the benefit of cerumen

Table 1. Subjects' and experimenter's judgment of manual and visual dexterity.

	Excellent/Good	Average	Fair/Poor
Manual Dexterity	38 (46)	11 (6)	4 (1)
Visual Acuity	33 (49)	11 (2)	9 (2)

Table 2. Subjects' and experimenter's judgment of amount of skin debris.

	None	Mild	Moderate	Significant	Severe
Amount of Skin Debris	5 (18)	18 (31)	20 (4)	10(0)	0 (0)

Table 3. Subjects' and experimenter's judgment of which ear produced more cerumen.

Earside	None	Right	Left
	34 (47)	9 (2)	10 (4)

management. The experimenter's observations were often made following recent cerumen management.

Table 3 reveals better agreement between the subjects and the experimenter concerning earside differences (which ear produced more cerumen), with both judging an absence of an ear difference.

To further examine the effectiveness of the experimental (adhesive) and control (extended receiver tubing) wax guards, a multiple regression analysis was conducted to determine which, if any, of the observed factors were related to the number of differences between the systems. The results revealed that only one factor was significantly related to the number of differences between the two wax guards. This was the amount of skin debris, which was significantly correlated to the number of differences ($r(51)=.41$, $p=.01$) and accounted for 64 percent of the variance. The relationship was such that as the amount of skin debris increased, there were more differences between the two wax guards with the adhesive system showing better control of wax and skin debris. This suggests that in ears which produce greater amounts of wax and skin debris, the adhesive system may be more effective. In addition, a second multiple regression analysis was performed using the subjects' reports rather than experimental observations. The only factor significantly related to the number of differences between the wax guards was manual dexterity ($r(51)=.74$, $p<.01$) which accounted for 86 percent of the variance.

CONCLUSIONS

1. Overall, the results suggest that the adhesive wax guard system was more effective than the control system in terms of

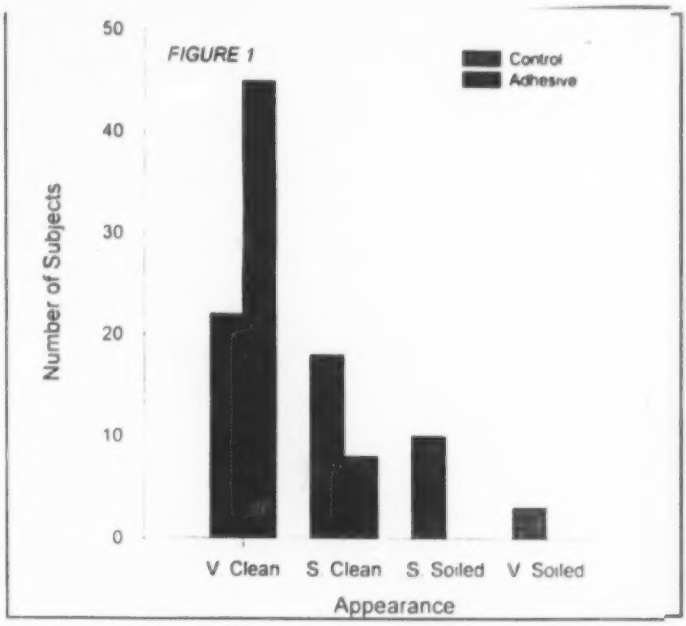


Figure 1 illustrates the experimenter's observations about the appearance of the adhesive wax guard and non-adhesive (i.e., control) instrument at the four week follow-up ("V. Clean"=very clean; "S. Clean"=somewhat clean; "S. Soiled"=somewhat soiled; "V. Soiled"=very soiled). It can be seen that the majority of the experimental wax guards appeared very clean, while most of the control instruments appeared either very clean or somewhat clean. It should be noted that 13 of the control wax guards appeared either somewhat soiled or very soiled, while none of the adhesive wax guards appeared so.

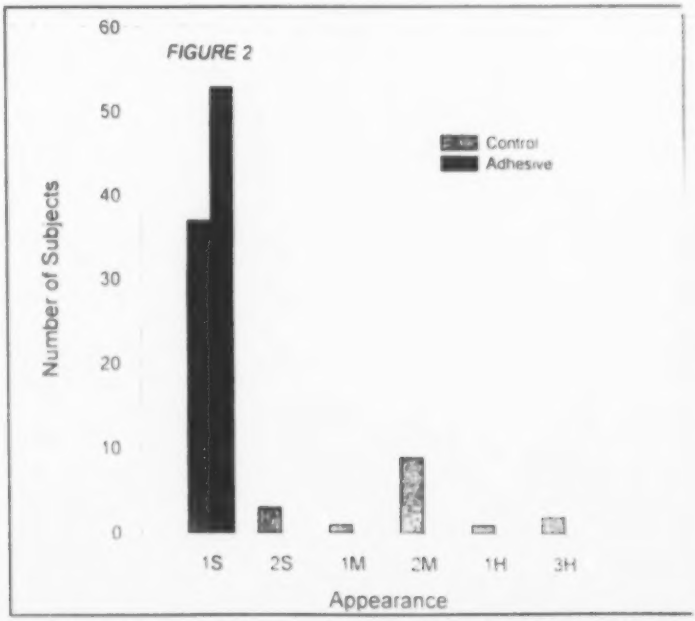


Figure 2 illustrates the experimenter observations about the degree and amount of penetration in the soundbores at follow-up ("S"=slight; "M"=moderate; "H"=high). It can be seen that while all 53 participants' aids with the adhesive wax guards showed only a slight amount of debris on the surface, this was true for only 37 of the control aids. In fact, 16 of them had moderate to heavy amounts of debris in the soundbore.

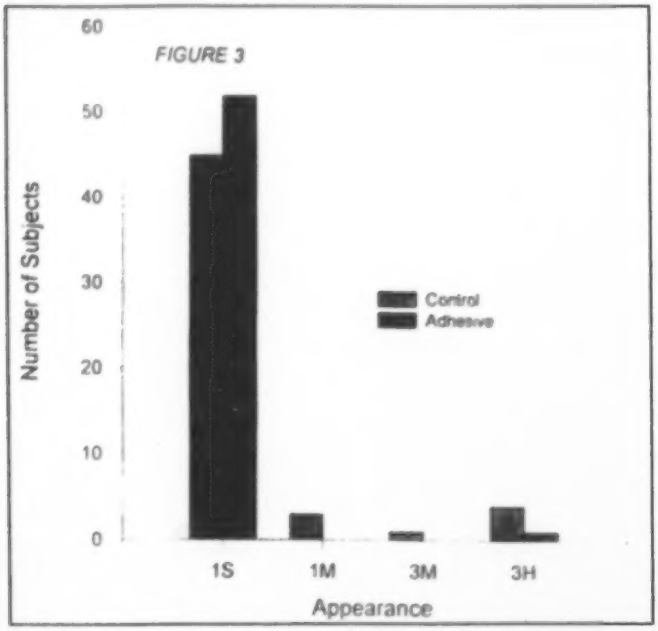


Figure 3 illustrates the degree and amount of penetration in the ventbores which was also examined ("S"=slight; "M"=moderate; "H"=high). Inspection of the data reveals that the majority of ventbores in both hearing instruments had slight amounts of debris on the surface of the hearing aids.

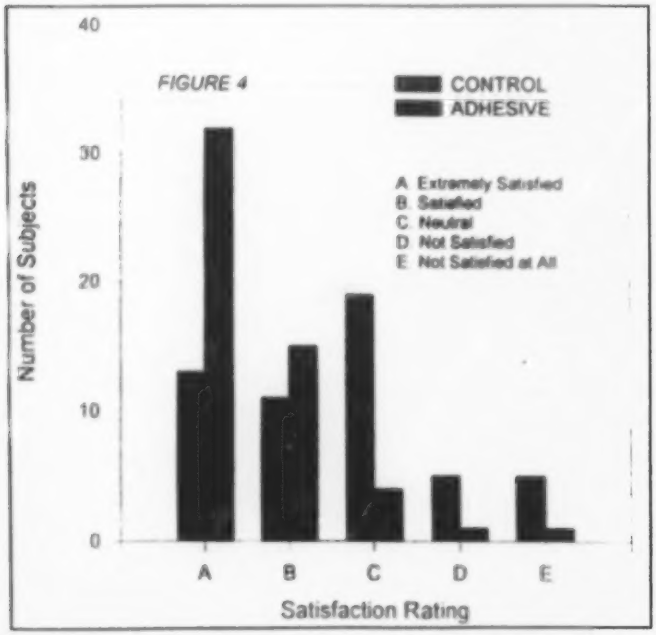


Figure 4 illustrates participants report of satisfaction with how wax was kept out of the aid by each wax guard. It can be seen that the majority of participants were extremely satisfied with the adhesive wax guard, while the most common response for the control wax guard was "neutral."

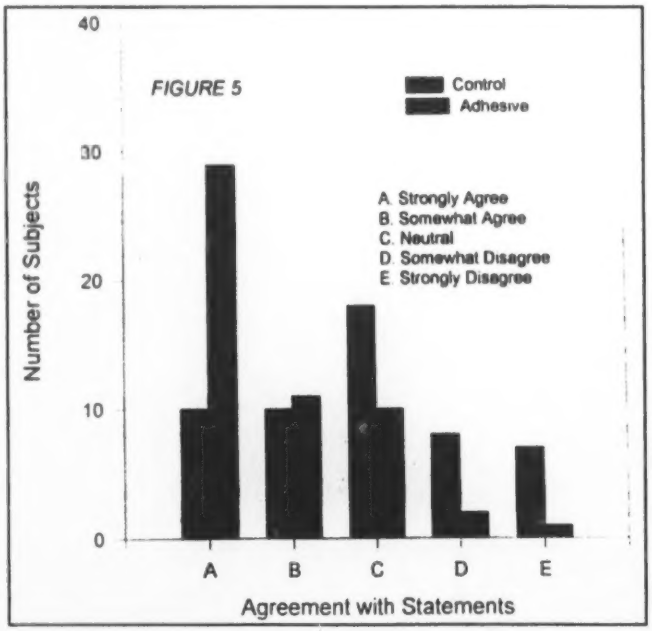
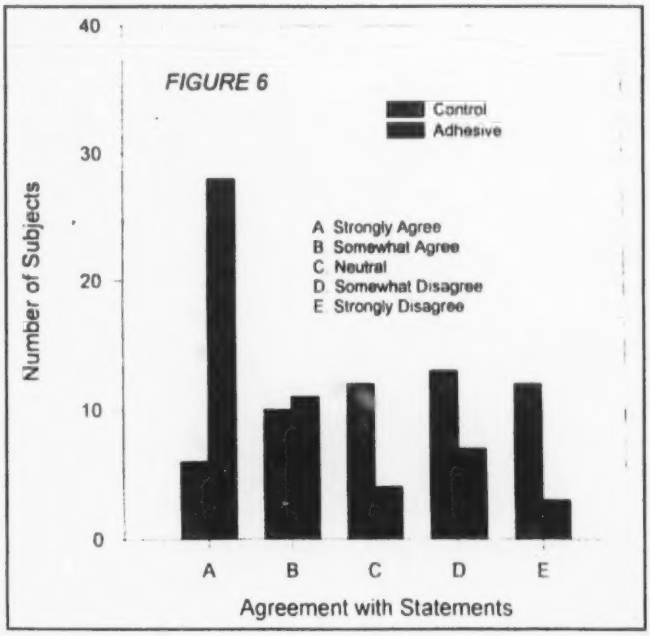


Figure 5 shows the response to the statement, "I would recommend the (adhesive or control) wax guard to other hearing instrument users." Results showed that the majority of participants strongly agreed (n=29) that they would recommend the adhesive system, while this was true for only 10 participants in terms of the control system. Most participants were neutral about recommending the control wax guard system to other hearing aid users.



The participants were also asked which of the two wax guards were easier to use for preventive maintenance. These results, shown in Figure 6, reveal that the majority of participants strongly agreed that the adhesive wax guard system was easier to use than the control wax guard system in terms of preventive maintenance.

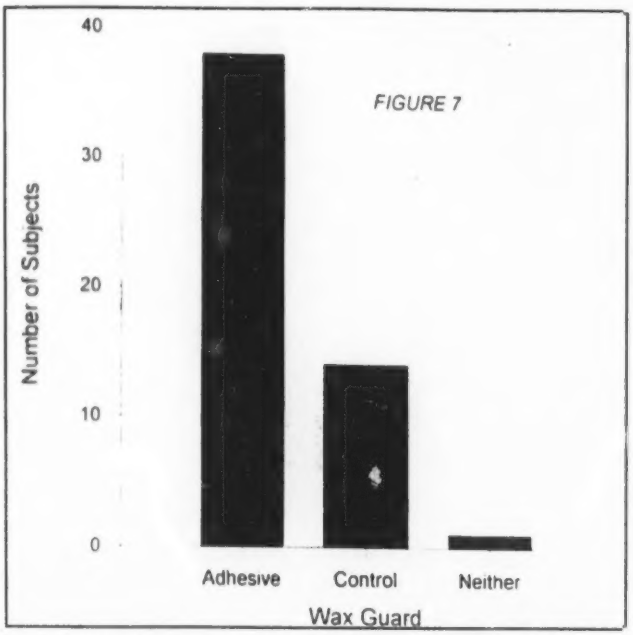


FIGURE 7

Participants were asked what system they preferred for keeping their hearing aids clean. The results in Figure 7 reveal that most participants preferred the adhesive wax guard system.

preventative maintenance. In terms of the amount and degree of penetration, greater amounts of wax and skin debris were found in control instruments.

2. Factors related to effectiveness appear to be manual dexterity and the amount of wax and skin debris presented by the participants.

3. The adhesive system also appeared to be more user friendly when compared to other systems as suggested by the results from the patient evaluation forms.

4. The adhesive wax guard system was preferred by the majority of participants, supporting the results of clinical findings.

Poster presented at the American Speech-Language-Hearing Association National Convention, Orlando, November 1995.

ACKNOWLEDGEMENT

This publication was based upon a poster presented at the American Speech-Language-Hearing Association Convention, Orlando, Florida, November 1995.

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Unusual Dysfluency: Repetitions in Final Position in an Adolescent Boy: A Poster Publication

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Typically, stuttering dysfluencies occur at the beginning of words or syllables. A rare pattern of dysfluency was noted in a twelve-year-old boy who was evaluated at Nova Southeastern University.

His dysfluencies included final part-word repetitions, several types of broken words, monosyllabic and polysyllabic whole word repetitions and phrase revisions. Strain, struggle and secondary behaviors were absent.

The Client: 12 year old male; native English speaker

• Attention deficit disorder; Rx = Ritalin; but no Ritalin during assessment

• No reported familial hx of communication problems

• Tested negative for central auditory processing deficits on May 30, 1996

Assessment Results:

Language — Assessment Session 1, June 14, 1996

• Expressive 1-Word Picture Vocabulary Test: 96th percentile

• Peabody Picture Vocabulary Test: 14th percentile

• Varied vocabulary noted during conversation

• CELF - R Formulated Sentences: 9th percentile

• CLEF - R Word Association: 25th percentile

Fluency — Assessment Session 1, June 14, 1996

• Stuttering Severity Instrument-3 [SSI-3]

Spontaneous Speech: 0.5 percent stuttered syllables; no tension or struggle; most disfluencies not considered as stuttering on the SSI-3; following the guidelines, one part-word repetition was counted

Reading: 1 percent Stuttered Syllablesone part-word repetition, one broken word

• Analysis of Spontaneous Sample 1:

Topic: Past Trips.

Syllables: 681 ~ Sentences: 40

Events of Typical Stuttering = 1; 0.1 percent of syllables

Nonstuttering Dysfluencies = 75; 11.0 percent of syllables

Fluency — Assessment Session 2, August 7, 1996

• Repeating long polysyllabic words: 100 percent fluent

• Speaking rate: slow to WNL; Reading rate WNL

• Analysis of Spontaneous Sample 2:

Topic: Lamp Assembly.

Syllables: 224 ~ Sentences: 15

Events of Typical Stuttering = 0

Nonstuttering Dysfluencies = 26; 11.5% of syllables

Denies dysfluencies; limited awareness

• Dysfluency Types:

See Figures 1 & 2 and Sample Excerpt

NSU CLIENT

Excerpt of Monologue from Session 2 Videotape

The subject's final part-word repetitions are in the form of a VC or VCV syllable and follow a fluent production of a word at the end of a phrase or sentence. A unique feature is noted: frequently the part-word repetitions cross phrase boundaries and function as starters for a new phrase or sentence.

In contrast, most accounts of final part-word repetitions in the literature report repetition of the final phoneme only and implicate neurogenic factors, environmental factors or phonological error processes.

Monologue: Assembly of a Table Lamp:

Now, what this is, (no(w) this here) is the base. (Ase) this part is where, (ere) the light turns on; (on) bulb and, (and), (um), cover hanger.

And the plug. First, (irst) you have, (have) to take, (get) the bulb. First you have to take the wires...(ires) like so...

Take these two wires over here...[brief audio intrusion]...and screw them in, into these two, and then screw these two wires on, onto here, (ere), and send the wire /d^/ (in).

Attach the two, in. Detach these two, [audible inspiration] (two) wires in here with a set of pliers, (iers).

Pull off this cap, (ap) detach the wire, (ire) send it through here 'til it's in the bottom, in this hole right over here.

Figure 1. NSU Client, Communication Sample 1: 681 Syllables

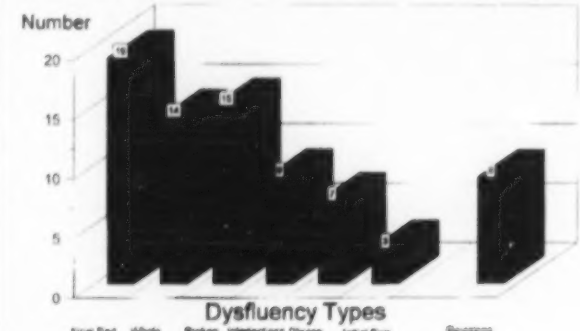

Figure 2. NSU Client, Communication Sample 2: 224 Syllables

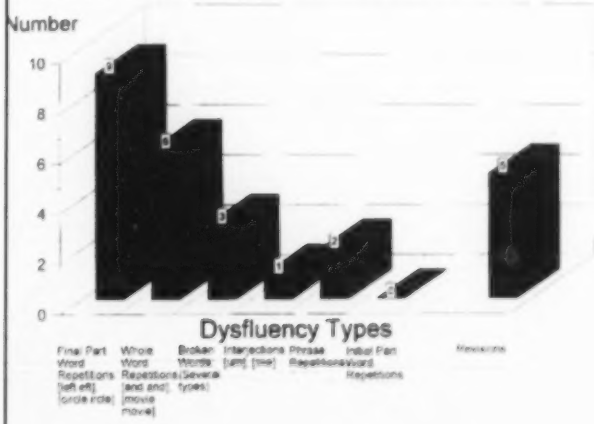

Table 1. Numbers of Dysfluencies: Rank Orders Across Conditions and Studies

	Nova Southeastern U. Client			University of Ghent Client				
Dysfluency Type	Sample 1 Rank:	Sample 2 Rank:	Mean Rank:	Conversation Rank:	Monologue Rank:	Monologue Under Masking Rank:	Mean Rank:	
Final Part Word Repetitions	1	1	(1)	3	1	1	(1.3)	FPWR
Word Repetitions	3	2	(2.5)	1	2	2	(1.7)	WR
Broken Words	2	3	(2.5)	2	5	4	(3.7)	BW
Interjections	4	5	(4.5)	5.5	3	3	(3.85)	INTJ
Phrase Repetitions	5	4	(4.5)	3.5	6	5	(4.83)	PRep
Initial Part Word Repetitions	6	((6)) [N = 0]	(6)	5.5	4	((6)) [N = 0]	(5.3)	IPWR
Revisions *	9	5		10	16	14		

*revisions were not ranked because they are not directly linked to the number of syllables per sample.

THE BELGIAN CONNECTION

In 1996, Van Borsel, et al. reported an unusual case at the University of Gent, a Dutch-speaking nine-year-old boy with a history of cerebral trauma.

Like the client at NSU, this boy produced multi-phoneme final part-word repetitions and word repetitions at ends of phrases or sentences. Examples: "Stap ap" "Noemt oemt" "En zie zegt dat zie dadelijk komt komt"

No other similar cases have been reported.

COMPARISON OF CASES AND DISCUSSION

- Rank orders of dysfluency types correspond
- All final part-word repetitions involved content words and were multiphonemic, usually at ends of phrases or sentences, with no tension and no secondary behaviors
- Reading: both nearly fluent; only Word Repetitions (both clients) & Final Part Word Repetitions (NSU client) noted.
- For the NSU client, revisions may relate to word selection or sentence formulation, not avoidance
- Final repetitions do not clearly resemble palilalia
- Neurogenic basis is uncertain for the Belgian boy and even more questionable for the NSU client
- Low awareness and involvement of units larger than the syllable suggest cluttering; but other factors do not suggest cluttering
- Treatment ideas: increase self-monitoring; try rate reduction; consider replacing repetitions with acceptable connective words at phrase boundaries; try sentence formulation practice.

ACKNOWLEDGEMENT

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Effect of Combining Speech-Language Intervention with Breakfast in Patients with Alzheimer's Disease: A Clinical Note

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The effect of combining speech-language intervention with breakfast in persons with Alzheimer's disease was investigated. Using an intervention strategy modeled after Boczko and Santo Pietro (1994), two clients diagnosed with Alzheimer's disease met with this clinician for sixteen sessions over a three week period. A variety of open-ended questions specifically designed to stimulate conversation were used. Post-test data indicated gains in communication for both clients, including number of responses given, number of verbally communicative responses and percentage of responses that were communicative (both verbal and gestural).

Alzheimer's Disease (AD) is a progressive, degenerative disease, evidenced by a loss of memory, change in personality, uncharacteristic behavior and deterioration in speech and language. AD is expected to affect as many as 14 million people by the year 2050 (National Institute of Aging, 1992). Traditional speech-language therapy has not been successful in halting, slowing or reversing the tragic alteration caused by this disease. Family members have assumed an extreme burden as their loved ones experience deterioration in language, memory and family relationships.

Thus far, no formal therapy program has been credited with retarding, delaying or reducing the destructive force of this disease on an individual's speech and language. Therefore, the efficacy of speech-language therapy is a significant issue for speech-language pathologists working with Alzheimer's patients. Bourgeois (1990, p. 29) has stated:

> Commonly held assumptions concerning the degenerative nature of the disease, the limited ability of patients to learn new information and the expected lack of maintenance of trained skills have discouraged speech-language pathologists from attempting therapeutic programs that might help to overcome the communication deficits of patients with Alzheimer's disease (1990, p. 29).

Boczko and Santo Pietro (1994) indicated that using a multi-modal communication interview with "mid-stage" AD patients increased conversational behavior. In their study, therapy sessions for five subjects were video-recorded and analysis of excerpts indicated that eye contact, body posturing, topic maintenance, questioning and use of names when addressing each other improved. Might combining speech-language intervention with the opportunity for socialization during breakfast facilitate increased use and/or extended maintenance of speech-language skills in persons with AD?

Two subjects were selected from among those diagnosed as having AD residing at the Whitehall Boca Raton, a rehabilitation facility. RO is a 93 year old white Jewish female, born in New York to a family of four children. As the owners of a neighborhood candy store, RO's parents both worked, but were accessible to their children at all times. RO married when she was 16 years old and moved to an estate in Connecticut where she and her husband maintained a stable. One wing of the estate became RO's art studio where she painted, sculpted and did pastels. RO and her husband traveled extensively via cruise ships in the earlier years and by airplanes and jets in later years. RO has been widowed for over 20 years. RO currently has only one surviving sibling, a sister who lives in Florida. As a resident of Whitehall Boca Raton, RO has been diagnosed with AD, hardening of the arteries, glaucoma, anemia, arthritis, osteoporosis and a mild bilateral hearing loss (presbycusis).

JE is a 78 year old white Catholic female born in New Jersey to a family of seven children. JE graduated from college with a teaching degree in physical education and worked as a girls' gym teacher. While attending high school and college, JE excelled in track and field events, including shotput, and was selected to represent the United States at the 1942 Olympic Games. JE traveled extensively as an amateur athlete, competing around the world. JE subsequently developed an interest in tennis and throughout her adult life has competed in international tennis. JE taught high school physical education until an accident mandated retirement. Several years ago, JE came to Whitehall for rehabilitation from the injuries involved in her accident. During her rehabilitation she has been diagnosed with AD, arthritis and hypoxemia.

The *Boston Assessment of Severe Aphasia (BASA)* (Helm-Estabrooks, 1989) was administered as a pre- and post-test. While reviewing possible baseline measure assessment alternatives, it was determined that this measure would provide a communication baseline and establish communication strengths and weaknesses. The *BASA* facilitated measurement of communication along seven different parameters: 1) Auditory Comprehension, 2) Praxis, 3) Oral-Gestural Expression, 4) Reading Comprehension, 5) Gesture Recognition, 6) Writing and 7) Visuospatial Tasks. An advantage of this measure is that the scoring system was constructed to characterize both verbal and nonverbal components in communication.

A series of four to six questions were prepared for each session. These questions all pertained to one topic. They were designed to promote conversation. Questions were similar to those listed below:

1. Tell me about the town where you grew up.

Table 1.

Boston Assessment of Severe Aphasia	RO Test #1	RO Test #2	JE Test #1	JE Test #2
AUDITORY COMPREHENSION-RAW SCORE	2	13	13	15
AUDITORY COMPREHENSION- % CORRECT	13%	81%	81%	94%
PRAXIS-RAW SCORE	6	6	6	6
PRAXIS-% CORRECT	100%	100%	100%	100%
ORAL-GESTURAL EXPRESSION-RAW SCORE	14	17	17	19
ORAL-GESTURAL EXPRESSION-% CORRECT	67%	81%	81%	95%
READING COMPREHENSION- RAW SCORE	4	8	8	6
READING COMPREHENSION-% CORRECT	36%	73%	73%	55%
GESTURE RECOGNITION -RAW SCORE	2	2	2	2
GESTURE RECOGNITION-% CORRECT	100%	100%	100%	100%
WRITING-SIGNATURE-RAW SCORE	1	1	1	1
WRITING-SIGNATURE-% CORRECT	100%	100%	100%	100%
VISUOSPATIAL-RAW SCORE	0	3	4	4
VISUOSPATIAL-% CORRECT	0%	75%	100%	100%
OTHER-RAW SCORE	3	6	7	7
OTHER-% CORRECT	43%	86%	100%	100%
BASA TOTAL	26	47	51	61
BASA PERCENTAGE CORRECT	43%	77%	85%	98%
GESTURAL-FULLY COMMUNICATIVE RESPONSES	20	31	27	35
PARTIALLY/SELF-CORRECTED RESPONSES	0	0	0	0
NONCOMMUNICATIVE GESTURAL RESPONSES		5	1	1 0
TOTAL GESTURAL RESPONSES	25	32	28	35
TOTAL GESTURALLY COMMUNICATIVE RESPONSES	20	31	27	35
% RESPONSES GESTURALLY COMMUNICATIVE	32%	40%	42%	43%
VERBAL-FULLY COMMUNICATIVE RESPONSES	21	37	35	45
PARTIALLY/SELF CORRECTED RESPONSES	0	3	4	2
NONCOMMUNICATIVE VERBAL RESPONSES		16	8	1 0
TOTAL VERBALLY COMMUNICATIVE RESPONSES	21	40	35	47
% RESPONSES VERBALLY COMMUNICATIVE	34%	50%	57%	57%
TOTAL (NONREFUSALS) RESPONSES	62	80	64	80
% RESPONSES COMMUNICATIVE	66%	90%	99%	100%

2. Tell me about the house or apartment where you lived.

3. What was it like to grow up in (name of town)?

4. What did you and your friends do for fun?

5. What did your parents do for fun back then?

6. Tell me about your room.

These questions all relate to growing up, to the distant past and avoid the difficulties due to possible short term memory deficits. Other topics included school and teachers, occupation or avocation and travel.

Each subject was assisted, both physically and verbally, to ensure their successful participation. Physical and verbal positive reinforcement e.g., a pat on the arm or on the back; a response of "good job" or "nicely done" were provided as frequently as possible. Encouragement was constant to promote self esteem and confidence. Negative or corrective comments made to the subjects were limited to phrases such as, "Please don't say you're stupid; you're a very smart woman. You just can't remember that right now." Errors in language and/or performance were ignored to reduce the subjects' reluctance to speak or participate due to a fear of failing. The subjects were encouraged to participate, e.g., "Now you tell me about your. . .".

Instructions for each session included readying the breakfast tray for consumption, e.g., "Are you having toast this morning?

Well, now would be a good time to butter your toast".

Each session lasted approximately one hour. Subjects were encouraged to engage in conversational interaction, between subjects, between subject and clinician and between the three parties seated at the breakfast table. The goal was to simulate normal mealtime conversation. A pre-test was given on July 9 and a post-test on July 25, 1996.

An analysis of the pre-test results demonstrated that RO performed at a significantly lower level than JE. RO gave 20 gesturally communicative responses to JE's 27. RO gave 21 verbally communicative responses to JE's 35. Sixty-six percent of RO's responses were communicative, whereas 99 percent of JE's responses were communicative.

Results of post-testing indicated improvement by both subjects. RO's gesturally communicative responses increased from 20 to 31, a rise from a score of 32 percent to 40 percent or an increase of 8 percent; JE's gesturally communicative responses increased from 27 to 35, a rise from 42 percent to 43 percent or an increase of 1 percent. RO's verbally communicative responses increased from 21 to 40; a rise from 34 percent to 50 percent for an increase of 16 percent; JE's verbally communicative responses increased from 35 to 47. Post-test results indicated an increase in the percentage of communicative responses: for RO, from 66 percent to 90 percent, an increase of 24 percent: for JE, from 99 percent to 100 percent, an increase of 1 percent. Results of pre- and post-testing are in Table 1.

Noncommunicative gestural responses decreased: for RO, from five to one a decrease of 80 percent; for JE, from one to none, a decrease of 100 percent. Noncommunicative verbal responses decreased from 16 to eight for RO, a decrease of 50 percent; for JE, decreased from one to zero, a decrease of 100 percent. Both subjects increased communication: RO increased responses given from 62 to 80, an increase of 23 percent; JE increased from 64 to 80, an increase of 20 percent. The difference that these score changes can be attributed to is the increase in communication opportunities provided.

Post-test data reflects an increase in communication. Analysis of the test results indicates positive changes for both clients (Table 1). These increases reflect the positive impact of combining speech-language therapy with an opportunity for socialization, specifically the breakfast meal.

Mealtime and conversation are paired naturally in our society. In the isolation and anxiety-producing confinement of a nursing home, residents demonstrate their fears by their withdrawal. Residents with AD are routinely cared for (i.e., bathed, dressed, served, fed, exercised, consoled and helped into bed). They are spoken to, instructed, explained to, advised and comforted. The functional goal of this intervention was to take a look at combining speech-language therapy with breakfast to facilitate language usage in clients with AD.

Positive results were demonstrated in this limited, short-term intervention. Further systematic and more comprehensive research is necessary. Multi-modal therapy such as speech-language therapy combined with any meal, walking, music or with art has potential for facilitating communication in persons with AD.

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Achievement of Client Expectations When Treating a Presurgical Male-to-Female Transsexual for a More Appropriate Female-Sounding Voice: A Clinical Note

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This report documents the case of a 32 year-old male who was in the transsexual process. The individual had been living as a "female" for 12 years, was in the pre-surgical stage and desired a more female-sounding voice. A female model whose pitch and dialect closely resembled those of the subject was used. Voice therapy focused on acquisition of feminine perceptual characteristics including elevated pitch, intonation, breathiness and resonance. At the conclusion of therapy, a questionnaire was administered to determine the degree to which client expectation was met.

Contemporary society is a composition of alternative lifestyles which are gaining increasing levels of recognition and acceptance. Transsexual populations, both pre and postsurgical, may seek therapeutic services from the medical and professional community. Transsexuals may be desirous of changing vocal perceptual characteristics to more closely resemble those of the sex that they are in the process of becoming or have already become. The speech-language pathologist working with this population has an obligation to be apprised of current trends in research and treatment techniques to alter vocal characteristics.

It is estimated that the transsexual population comprises only a small minority of the adult population in the U.S. Nonetheless, these persons have distinct speech and voice therapy needs. Upon choosing to enter therapy, the transsexual client will typically have personal expectations of how his/her voice will sound with intervention. These expectations must be considered by the clinician when establishing a treatment plan.

Transsexualism has been described by Troncoso and Witkind (1994) as the paradox wherein the person has a lifelong history...of a desire to be of the sex opposite the present anatomy, chromosomes and endocrine secretions. The individual manifests a gender behavior pattern opposite to his anatomical sex and an emotional state characterized by anxiety, depression and restlessness.

For many, the answer is sexual "reassignment" surgery or sex change. Ebaugh (1988) found that "the common reactions among transsexuals immediately after sex change surgery are tremendous relief, feeling at peace with oneself, elation that now their outward appearance matches their inward self" (p. 126). Wolfe, Ratusnik, Smith and Northrop (1990) found that males comprise the majority of clients desirous of sex change by a ratio of approximately three to one. Feminizing hormones are routinely prescribed for these anatomically male clients. While these hormones do enhance female characteristics and minimize male characteristics, they do not have an effect on the larynx; for example, vocal pitch is not elevated. Wiltshire (1995) reported that experimental surgeries to alter the voice have been conducted wherein vocal fold tissue has been surgically shortened and thinned to elevate vocal pitch. Such studies have been conducted outside the United States and have tended to be over a limited duration.

More frequently, male-to-female transsexuals have consulted speech pathologists to achieve a more feminine sounding voice. However, higher pitch is not the only perceptual attribute listeners associate with what makes a voice "feminine." It has been suggested that some of these distinguishing perceptual characteristics are learned behaviors (Wiltshire, 1995). Wolfe, et al. (1990) found that, in addition to lower fundamental frequencies, transsexuals categorized as having "male" voices had more extensive downward intonation, a lower percentage of upward and downward shifts and a larger percentage of level intonation and level shifts. With regard to acquisition, Wiltshire (1995) contends that as children, boys display a tendency to protrude the lips, with a resulting increased overall length of the vocal tract with enhanced resonance characteristics. Conversely, girls tend to spread the lips, as in smiling, which results in an overall shortening of the vocal tract, minimizing certain resonance characteristics. Differences in vocal play are also evident from an early age. For example, boys may use harsher, lower frequency sounds which mimic car engines, motorcycle sounds, etc. Girls may use softer, reassuring tones while caressing dolls or playing house. Wiltshire (1995) states that these routines have direct implications for therapy:

The task for male to female transsexuals in vocal rehabilitation is to learn adaptive strategies to manipulate the existing vocal tract to sound more female-like and also to adapt communication strategies that are distinctive features employed in female speech that serve to differentiate male and female speech (p. 53).

Depending on the assessment, client choices and expectations, various objectives can be jointly targeted for therapy. Troncoso and Witkind (1994) reported that therapy approaches may include:

1. Encouraging the use of successively higher pitch levels

   a) Increasing the higher end of pitch range

   b) Increasing habitual pitch level

2. Implementing feminine inflection patterns

3. Changing vocal tract resonance characteristics

a) Promoting breathy vocal attack

b) Modifying tongue carriage

These authors reported successfully treating two male-to-female transsexuals for voice change. Their clients were satisfied with their acquired female-sounding voices.

Wiltshire (1995) has summarized that much of the work which has been done to date with male-to-female transsexual voice change involves the assumption that pitch is the most salient feature of the female voice. Therefore, therapeutic interventions have tended to emphasize raising the client's pitch. Only one study (Karla, 1976) claimed to have attained the mutual satisfaction of both client and clinician by successfully raising pitch.

The Client

In November 1994, RS, a 32-year old pre-surgical male-to-female transsexual, sought to receive speech pathology services to facilitate acquisition of a "female-sounding" voice. He indicated that presurgical transsexuals may attempt to get a head start in preparation for their future female persona. RS had been living as a "female" for 12 years and had been taking feminizing hormones for the past four years.

Assessment , Plan and Results

An acoustical and perceptual voice evaluation was conducted initially. Thereafter, each therapy session began with a review of the previous session. The clinician requested input from the client regarding therapeutic procedures, progress and carryover. At the conclusion of therapy, the client was provided a questionnaire to determine whether the client's expectations for therapeutic outcome were achieved.

On November 30, 1994, the client's voice was assessed. It was perceived as "male-sounding," with occasional glottal fry and frequent downward shifts in intonation. Mean frequencies were measured as 182 and 198 Hz during a prolonged /ah/, 119 and 127 Hz during the reading of the "Rainbow Passage," and 189 and 208 Hz during "pageant speech" (speech used while entertaining). Frequency range was determined to be between 108-683 Hz. Stimulability was observed when repeating sentences exhibiting voice without glottal fry, voice with increased breathiness, light contact and decreased downward shifts in intonation, as modeled by a female clinician. After the client's voice assessment and prior to planning therapy objectives, the clinician and the client had the following conversation:

Q "Overall, how would you like me to help you change your voice?"

A "I want to sound more like a woman."

Q "What are your expectations for how your voice will sound after therapy is completed?"

A "My voice should sound higher, you know, like a woman."

Q "Are there specific voice characteristics you would like to work on?"

A Well, I know that when I talk this high, I want to be able to keep it like that and I can't cuz then my voice starts to hurt and bother me."

Q "Can you provide an example of a known female voice, such as an actress, that you would want to sound like?"

A "Well, I guess I have to think about that."

After educating the client about the factors that compose the female voice, the client suggested Dixie Carter, an actress in the television program *Designing Women*. This actress was selected and considered realistic by the clinician because, perceptually, she presents with a low female pitch and a regional affect that was comparable to that of the client.

On December 7, 1994, the client demonstrated an increased awareness and use of modeled speech when engaging in conversation with clinicians at the end of therapy. On December 14, 1994, utilizing the Visi-Pitch, the client's repeated sentences often sounded perceptually different as the client produced a replica of the graphic pattern of the modeled pitch displayed on the screen. Throughout the therapy session, the client demonstrated an increased use of female-modeled speech when engaging in general conversation with the clinician. During this session, the client expressed a concern about possible reflux affecting pitch in the morning and expressed an interest in vocal hygiene and diet management. Anti-reflux precautions were provided.

To determine the effect of therapy and the client's satisfaction with the results, a questionnaire was provided to the client (Appendix A). Those questions and a synopsis of the client's responses follow. The client is referred to in the female gender.

Question 1 asked what was the client's original expectation of how her voice would sound after therapy. This issue was addressed during the first therapeutic session. At that time the client indicated a desire for a higher pitch and a more feminine quality. The questionnaire response is consistent with information previously provided by the client and was the anticipated response.

Question 2 clarified the information in Question 1 by defining expectations in terms of pitch, female intonation patterns, breathiness and resonance. During the therapeutic sessions, this terminology was utilized and explained to the client. As the client's awareness of these terms grew, she became capable of providing a more detailed explanation of her expectations, as indicated on the questionnaire. These responses were also anticipated.

Question 3 asked if expectations changed as therapy progressed. The client responded affirmatively. With education, the client began to realize that the female voice is not merely a male voice with an elevated pitch. Instead, it is a combination of factors, including increased breathiness, intonation patterns with greater variation, a pitch in the same range or slightly elevated and a change in resonance altered by a more forward tongue carriage. Not surprisingly, the client explained that her expectations did change. She "found that it wasn't necessary to have a high voice but rather a soft and melody-type voice."

Question 4 asked if the expectations of therapy were achieved. The client responded yes, which was consistent with the clinician's interpretation. It was the opinion of the clinician that although expectations of therapy were achieved during therapy, additional sessions would be essential to ensure carryover. Demonstration of a skill during therapy is the first step in true acquisition of that skill. Carryover is insured with additional therapy.

Question 5 asked if there were treatment goals that the client would have liked to target that were not targeted. The client responded negatively. The rationale for this response is that treatment goals were discussed initially, allowing the client to contribute her hopes for therapy. All reasonable goals were incorporated into the therapy plan. Goals deemed unreasonable by the clinician were explored and discussed with the client. By educating the client as to rea-

sonable expectations, therapy began with both the client and clinician anticipating the same positive outcome. Question 6 asked if the client felt the clinician was skilled in providing therapy. Speech therapy is often conducted in a one-on-one environment. The establishment of rapport, trust and confidence in the clinician's skills to achieve therapy goals is vital to success. The rationale for including this information in the questionnaire is to allow the client the opportunity to confirm or negate the existence of rapport, trust and confidence in the skills of the clinician, which may be a factor if expectations were not achieved. The client responded affirmatively, that she felt the clinician was skilled in providing therapy.

Question 7 asked if the client was comfortable and at ease with the clinician. A client will perform better in a comfortable environment than in one filled with stress, insecurity or an ill-at-ease feeling. The client indicated comfort and ease with the clinician.

Question 8 asked the most important question of all: "Are you satisfied with the result of therapy?" The client answered, "Yes." A problem is only a problem if it exists as a problem for the client. When it ceases to be a problem for that client, it may no longer warrant therapy. In this instance, the clinician and the client disagreed. The clinician would have preferred additional therapy to insure carryover. However, the client felt satisfied with the education and techniques provided in therapeutic sessions. When the client returned to Fort Lauderdale, the clinician telephoned the client and attempted to encourage additional therapy. The client indicated that she felt confident she could incorporate the newly acquired techniques into her daily speech. The clinician was concerned about the possibility that the client was not incorporating therapeutic techniques as well as she was able and that this could interfere with carryover. At a later date, during a chance encounter, the client demonstrated an "unnaturally " elevated pitch and did not seem to be using other techniques facilitated in therapy. Nonetheless, it was apparent that although the clinician was not satisfied with the client's ultimate voice, the client was.

Question 9 asked specifically, "Are you satisfied with pitch, female intonation patterns, breathiness and resonance?" The client answered affirmatively for all characteristics.

Question 10 asked for the most beneficial aspect of therapy. The client indicated a home practice program and use of the Visi-Pitch.

Question 11 asked the client to select an overall rating for the therapy procedures provided. The client circled "4" (excellent). The clinician would have circled "3" (good), due to the clinician's desire to implement carryover. However, the clinician did feel that excellent therapeutic procedures were followed for the limited therapy provided.

Question 12 asked the client to select an overall rating for her present female sounding voice. The client circled "3" (good). The clinician would have circled "2" (fair).

Based on the client's responses to the survey, it is clear that this client's expectations for a more appropriate female sounding voice were met. The client's responses reveal that client education properly acquainted the client with healthy and realistically attainable expectations.

Because carryover of newly acquired skills is a key ingredient in successful therapy and because during two isolated post-therapy conversations, carryover was not achieved on a consistent level, the clinician would have preferred continued therapy. This was shared with the client. However, the choice remained the client's. Speech-language pathologists have an obligation to inform the professional/medical community and the transsexual community about the variety of therapy techniques available to modify voice. In addition, speech-language pathologists should be able to demonstrate a level of professionalism that exceeds any personal bias. Patient satisfaction is an important clinical indicator. This client was satisfied with her therapeutic outcome.

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APPENDIX A: QUESTIONNAIRE

1. What was your original expectation of how your voice would sound after therapy?
2. Can you specify what you originally expected to increase (+) or decrease (-)?
3. Pitch (+)_____ (-)_____
4. Breathiness (+)_____ (-)_____
5. Female Intonation Patterns (+)_____ (-)_____
6. Resonance (+)_____ (-)_____
7. As therapy progressed, did your expectations change? Yes____ No____ If yes, please explain.
8. At the conclusion of therapy, were your expectations of the therapy achieved? Yes____ No____. If no, please explain.
9. Were there treatment goals that you would have liked to target that were not targeted? Yes____ No____. If yes, please explain.
10. In your opinion, was the clinician skilled in providing therapy? Yes____ No____.
11. Were you comfortable and at ease with the clinician? Yes____ No____. If no, explain.
12. Please provide suggestions for improvement.
13. Are you satisfied with the results of therapy? Yes____ No____. If no, please explain.
14. Specifically, are you satisfied with:

a) Pitch Yes____ No____.

b) Breathiness Yes____ No____.

c) Female Intonation Patterns Yes____ No____.

d) Resonance Yes____ No____.

1. What do you think was the most beneficial aspect of therapy?
2. Please circle overall rating for therapy procedures provided.

1 poor

2 fair

3 good

4 excellent

3. Please circle overall rating for our present female sounding voice.

1 poor

2 fair

3 good

4 excellent

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